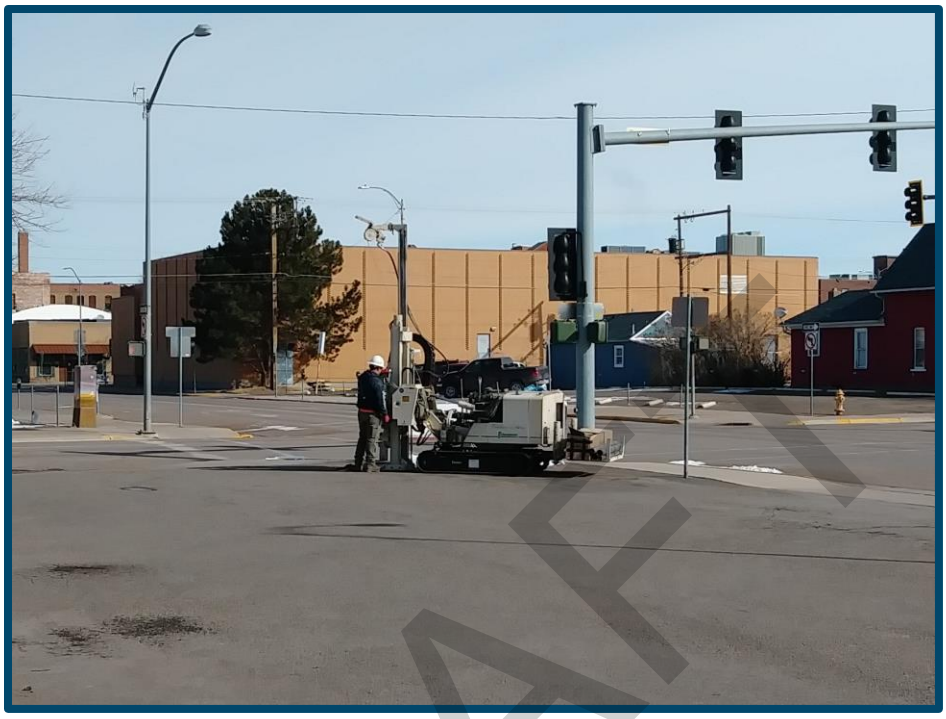
1800 River Drive North
Great Falls, MT 59401

406.761.3010
tdhengineering.com



PHASE II ESA REPORT - DRAFT

206 5TH STREET SOUTH – GREAT FALLS, MONTANA
GRANT NUMBER: BF95809510-0

CLIENT

Great Falls Development Authority
406 3rd Street NW, Suite 203
Great Falls, MT 59403
Attn: Lillian Sunwall

ENGINEER

TD&H Engineering
1800 River Drive North
Great Falls, MT 59401
Engineer: Peter Klevberg, PE

JOB NO. 21-035

APRIL 2022

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1.0 EXECUTIVE SUMMARY

The property located at 206 5th Street South in Great Falls, Montana, shown on Figure 1, is currently occupied by two commercial tenants. The property has consisted of a tire shop, was reportedly a gas station, and is now an outdoor recreational equipment store. No recognized environmental conditions (RECs) were uncovered during the Phase I Environmental Site Assessment that was completed for the Property by TD&H Engineering (TD&H) in February 2021.

A field investigation was conducted on March 11, 2022, to plug an existing data gap and evaluate whether soil contamination is present as due diligence in support of financing for purchase and redevelopment of the property. TD&H drilled four boreholes at locations intended to bracket likely release areas on the property. Four soil samples were sent for analytical testing at a certified laboratory. Multiple soil samples were analyzed for headspace in the field. Ground water appears to be perched and limited to isolated zones within the fat clay. One soil sample was collected at the apparent ground water interface. None of the soil samples had detectable concentrations of petroleum hydrocarbons. Based on the field observations and data report, no additional investigation is warranted.

SITE BOUNDARY

NOT FOR CONSTRUCTION

BIGHORN OUTDOOR SPECIALISTS
GREAT FALLS, MONTANA

PROJECT LOCATION MAP

TD&H Engineering
tdhengineering.com

DRAWN BY:	DJK
DESIGNED BY:	
QUALITY CHECK:	
DATE:	2021-11-19
JOB NO.	21-035
CAD NO.	FIGURE 1

FIGURE
1

2.0 BACKGROUND

TD&H completed a Phase I Environmental Site Assessment ESA on the property in February 2021. There are no known previous environmental site assessments performed on the property. As described in the Phase I report, the property has consisted of a tire shop, was reportedly a gas station, and is now an outdoor recreational equipment store. No recognized RECs were uncovered during the TDH&H Phase I ESA; however, based on the historic use of the property as an automotive repair shop and a gas station, it is possible that soil contamination occurred at the site. These activities preceded current underground storage tank regulations.

The property consists of 0.344 acres (two city lots) and occupies the southwest corner of the intersection of Fifth Street South and Second Avenue South on the south side of downtown Great Falls, Montana. The east half of the property is a paved parking lot, while the west side is occupied by a single-story building, most of which houses the retail sales, storage, and shop areas of Bighorn Outdoor Specialists. The south end of the building is occupied by The James Company Realty, Inc. Topography is approximately flat and level.

3.0 PURPOSE OF INVESTIGATION

The purpose of the Phase II ESA is to plug an existing data gap and evaluate whether soil contamination is present as due diligence in support of financing for purchase and redevelopment of the property.

4.0 METHODS

Methods followed are detailed in the work plan in Appendix A. Prior to the scheduled drilling, a utility locate was requested and completed. There were no buried utilities identified near the proposed boring locations.

Borehole drilling locations, shown on Figure 2, were selected at locations intended to bracket likely release areas on the property. The northeast boring is intended to intercept any contamination from the former fueling station that was reportedly at this location. The other borings are intended to intercept contamination that may have resulted from releases from drains or pits. A total of four soil borings were drilled using a Geoprobe 6610X direct push drill rig. Each boring was logged by an experienced TD&H technician.

Between each borehole, the drilling and sampling equipment was decontaminated by washing each piece with soapy water to remove any adhered soil. Sampling equipment was further decontaminated by spraying with a 10% methanol solution. Deionized water was then applied to remove the methanol solution. A detailed description of the decontamination procedure is found in SOP-2 in the work plan in Appendix A.

Once the boreholes were logged and sampled, each one was backfilled with soil that had been extracted from the borehole and mixed with bentonite.

All sampling and equipment decontamination were completed in accordance with the approved work plan located in Appendix A.

BH0-1 SOIL BORING LOCATION

SITE BOUNDARY

NOT FOR CONSTRUCTION

BIGHORN OUTDOOR SPECIALISTS
GREAT FALLS, MONTANA

SOIL BORING LOCATION MAP

TD&H Engineering
tdhengineering.com

DRAWN BY:	DJK
DESIGNED BY:	
QUALITY CHECK:	
DATE:	2021-11-19
JOB NO.	21-035
CAD NO.	FIGURE 2

FIGURE
2

5.0 FINDINGS

Field and laboratory data are presented in this section. TD&H completed four soil borings, field screening, soil sampling, and data analysis.

5.1. Description of Soil from Borings

Each boring was logged as it was drilled. Sampling was continuously in five-foot or two-and-one-half-foot runs. Actual sampled intervals are shown on the boring logs in Appendix B. Different soil types convey potential petroleum contamination in different ways. Sandy soils allow free liquid to move more easily through the soil profile, while clayey soils are less permeable and more likely to have surfaces that bind with the contamination and retain it in place. Lithologic classification is therefore very important.

All four soil borings had similar profiles. A surface asphaltic pavement layer, underlain by poorly-graded sand and gravel, varied in thickness between the four borings. In each of the borings, the sand and gravel is underlain by a native, impermeable fat clay:

- BHO-1 had poorly-graded sand to 4.0 feet. Angular gravel fill was observed from 4.0 to 4.2 feet. The gravel was underlain by an impermeable, fat clay. No hydrocarbon odor was present. Although ground water was not encountered, the clay was very moist below 4.2 feet.
- BHO-2 had poorly-graded sand to 4.0 feet. The sand was underlain by an impermeable, fat clay. No hydrocarbon odor was present. Although ground water was not encountered, the clay was very moist.
- BHO-3 had poorly-graded gravel with sand base course to 2.5 feet. Poorly-graded sand was observed between 2.5 and 4.0 feet. The sand was underlain by an impermeable, fat clay. No hydrocarbon odor was present. Although ground water was not encountered, the clay was very moist.
- BHO-4 had poorly-graded gravel with sand base course to 2.5 feet. The gravel was underlain by an impermeable, fat clay. No hydrocarbon odor was present. Ground water was encountered in a sand seam at 11.6 feet and in occasional pockets at shallower depths.

Occasional alkali salts on fractures were observed in the BHO-1 clay. Sand stringers were observed in BHO-2, BHO-3, and BHO-4 clay.

Free water was only encountered in the BHO-4 boring. However, each of the borings exhibited moisture. This moisture was encountered at rather shallow depths and may result from perched water within the clay.

5.2. Field Screening Results

A photoionization detector (PID) was used to measure headspace organic vapor concentration in soil samples from each boring at various depths, generally based on changes in soil type. The results of the headspace analysis are provided in Table 1. Bolded depths indicate grab samples that were submitted for laboratory analysis. The laboratory analytical report is included in Appendix C.

Table 1 Field Screening Results 206 5th Street South		
Depth (ft)	**Headspace (ppm)**	**Odor**
BHO-1		
2.5-3.0	2.0	None
4.0-4.5	0.0	None
7.0-7.25	1.0	None
9.0-9.25	0.2	None
14.0-15.0	0.7	None
BHO-2		
3.5-4.0	0.0	None
7.75-8.0	0.0	None
12.5-13.0	0.0	None
14.0-15.0	0.0	None
BHO-3		
3.5-4.0	0.0	None
4.5-5.0	0.3	None
5.0-5.5	0.0	None
7.0-7.5	0.0	None
9.5-10.0	0.8	None
BHO-4		
2.5-3.0	2.0	None
3.25-4.0	1.0	None
4.0-5.0	1.7	None
7.0-7.5	0.1	None
11.5-12.0	0.0	None

Field screening, along with visual and olfactory evidence of hydrocarbon impacts, helped guide soil sampling efforts in an attempt to identifying soil with volatile organic compounds (VOCs). Samples were selected for laboratory analysis based on the headspace result obtained by using the PID or were located at the depth most likely to represent a possible ground water interface. In the absence of any apparent contamination, then the sample from the bottom of each boring was submitted to the laboratory.

5.3. Soil Analytical Results

Soil samples were shipped under chain-of-custody protocol to Energy Laboratories, Inc. (Energy) located in Helena, Montana, for analysis. The results of laboratory analysis of the soil samples are provided in Table 2. The DEQ risk-based screening level (RBSL) for each compound was identified and is listed in the table as the default RBSL value. As can be seen in the table below, none of the soil had detectable concentrations of petroleum hydrocarbons.

Laboratory results are provided in Appendix C.

Table 2 Soil Sampling Results 206 5th Street South															
Laboratory Results															
	1,2 – Dibromoethane	1,2 – Dichloroethane	Total Extractable Hydrocarbons (TEH)	Methyl-tert-butyl Ether	Benzene	Toluene	Ethylbenzene	m&p-Xylene	o-Xylene	Total Xylenes	Naphthalene	C9-C10 Aromatics	C5-C8 Aliphatics	C9-C12 Aliphatics	Total Purgeable Hydrocarbons
RBSL**	**8.6E-5***	**0.019**	**200**	**0.078***	**0.07**	**21**	**26**	**[-]**	**[-]**	**320**	**12**	**130**	**220**	**640**	**100**
Depth Interval (ft.)	**Concentration in mg/kg**														
BHO-1															
14.0-15.0	<0.00029	<0.0073	<24	<0.15	<0.073	<0.073	<0.073	<0.073	<0.073	<0.073	<0.15	<2.9	<2.9	<2.9	<2.9
BHO-2															
14.5-15.0	<0.00029	<0.0072	<14	<0.14	<0.072	<0.072	<0.072	<0.072	<0.072	<0.072	<0.14	<2.9	<2.9	<2.9	<2.9
BHO-3															
9.5-10.0	<0.00027	<0.0068	<14	<0.14	<0.068	<0.068	<0.068	<0.068	<0.068	<0.068	<0.14	<2.7	<2.7	<2.7	<2.7
BHO-4															
11.5-12.0	<0.00027	<0.0069	<13	<0.14	<0.069	<0.069	<0.069	<0.069	<0.069	<0.069	<0.14	<2.8	<2.8	<2.8	<2.8
Field Duplicate	<0.00027	<0.0068	<13	<0.14	<0.068	<0.068	<0.068	<0.068	<0.068	<0.068	<0.14	<2.7	<2.7	<2.7	<2.7

Samples were collected 11 March 2022 using a Geoprobe 6610X Direct Push rig.

*Per Montana DEQ: “The best achievable practical quantitation limit (0.20) is greater than the RBSL; therefore, if the compound is detected, additional evaluation may be necessary.

**From Table 1-Tier 1 Subsurface Soil, <10 feet to Ground Water, RBSLs and Standards – Montana Risk-Based Corrective Action Guidance for Petroleum Releases (May 2018)

6.0 DATA VALIDATION

As dictated by the SAP, data gathered as part of the Phase II ESA investigation required validation. As part of the validation process, sampling techniques, laboratory results, laboratory procedures, and laboratory QA/QC processes were scrutinized. Standard data validation forms are included in Appendix D.

Energy performed analyses of soil samples taken at the site located at 206 5th Street South in Great Falls, Montana. For these analyses, Energy utilized ASTM D2974 for percent moisture, EPA Method 8260B for VOCs, SW8015M for EPH, and MA-VPH methods. Samples were received in good condition and at appropriate temperatures, with completed chain of custody, and analyzed within holding times. A duplicate sample was taken in the field, but an equipment blank was not. Percent recoveries for matrix spike (MS) and matrix spike duplicate (MSD) analytes were within acceptable limits. Surrogate p-Bromo fluorobenzene was outside acceptable limits of 81-144%. While this value is outside the acceptable limits, it is close enough, 2% lower than the lower limit, that any negative results were likely minimized. As with the soil samples, the duplicate sample did not contain hydrocarbons (see Table 3).

Table 3
Soil Duplicate Comparison
206 5th Street South

Sample:	Lab-Adjusted MDL (mg/kg):	TEH (mg/kg)	Aliphatic, Adjusted (C05-C08) (mg/kg)	1,2-Dibromoethane
		13-24	2.7-2.9	0.00027-0.00029
	Sample Date and Time:			
BH-1 [14.0-15.0]	3/11/2022 9:40	<24	<2.9	<0.00029
BH-2 [14.5-15]	3/11/2022 11:00	<14	<2.9	<0.00029
BH-3 [9.5-10.0]	3/11/2022 12:00	<14	<2.7	<0.00027
BH-4 [11.5-12.0]	3/11/2022 13:00	<13	<2.8	<0.00027
Field Duplicate (BH-4 [11.5-12.0]	3/11/2022	<13	<2.7	<0.00027

7.0 POTENTIAL RECEPTORS

Receptors are humans or organisms that are or may be exposed to chemicals of concern in environmental media (surface soil, ground water, outdoor air, etc.). Chemicals of concern were not detected during the Phase II ESA, therefore; the level of risk is low.

8.0 CONCLUSIONS

Soil samples were collected from locations with the highest evident potential for pollution from historical sources. Ground water was intercepted in one of the soil borings and a soil sample was collected at the soil ground water interface. While this ground water likely represents an isolated pocket of perched water, the presence of the water in a soil of very low permeability indicates this interval would likely show evidence of contamination had a petroleum release occurred in this area. None of the soil samples had detectable concentrations of petroleum hydrocarbons.

9.0 RECOMMENDATIONS

Based on the data obtained, site soils are not impacted. No additional environmental investigation of the soil appears warranted based on these data, and no soil removal will be needed.

10.0 LIMITATIONS

The information contained within this report is limited to information gathered during the subsurface investigation, minimal historic data provided by others, and laboratory report provided by Energy. Conditions or areas that were not included in the scope of work are not addressed in this report unless specifically mentioned. The scope of this assessment is limited to the utility locate, soil borings, field screening, and laboratory analysis of soil for petroleum hydrocarbons.

TD&H does not guarantee the accuracy or completeness of information obtained from or compiled by other sources. Information that was not reasonably ascertainable, or that was beyond the scope of work, may have an impact on the conclusions to this assessment. Future site conditions are outside the scope of this report.

This report has been prepared in accordance with generally accepted practices reflecting the standard of care for consulting work of this type and in this region. This report is for use by the client for the designated purposes. The findings, analyses, and recommendations contained in this report reflect our professional opinion regarding potential environmental impacts to the subsurface and how these conditions may affect the proposed project. Our conclusions are based on site conditions encountered. Our analysis assumes that the results of the exploratory borings are representative of the subsurface conditions throughout the site, that is, that the subsurface conditions everywhere are not significantly different from those disclosed by the subsurface study. Unanticipated soil conditions are commonly encountered and cannot be fully determined by a limited number of soil borings and laboratory analyses. Such unexpected conditions frequently require that some additional expenditures be made to obtain a properly constructed project. Therefore, some contingency fund or other contingency planning is recommended to accommodate such potential conditions.

The recommendations contained within this report are based on the subsurface conditions observed in the borings and are subject to change pending observation of the actual subsurface conditions encountered during construction. TD&H cannot assume responsibility or liability for the recommendations provided if we are not provided the opportunity to perform limited inspection and confirm the engineering assumptions made during our analysis when excavation or other site activities make such observation possible. Unforeseen conditions or undisclosed changes to the project parameters or site conditions may warrant modification to the project recommendations.

Long delays between the subsurface investigation and the start of site remediation, redevelopment, or construction increase the potential for changes to the site and subsurface conditions which could impact the applicability of the conclusions and recommendations provided. If site conditions have changed because of natural causes or construction operations at or adjacent to the site, TD&H should be retained to review the contents of this report to determine the applicability of the conclusions and recommendations provided in light of the time lapse or changed conditions.

This report is intended for use by the users, the Great Falls Development Authority, and their clients. The scope of services performed by TD&H Engineering may not be appropriate to satisfy the needs of other users, and any use or re-use of this documents or the findings presented herein are at the sole risk of the user.

Corey League *CHMM*
Project Manager
TD&H Engineering

Peter Klevberg *PE*
Environmental Services Manager
TD&H Engineering

11.0 REFERENCES

- Montana Cadastral: http://svc.mt.gov/msl/mtcadastral#
- Google Earth
- Montana DEQ Risk-Based Screening Levels: https://deq.mt.gov/files/Land/LUST/Documents/RBCA/RBCAGuidance-May_2018.pdf

APPENDICES

APPENDIX A
Work Plan

1800 River Drive North
Great Falls, MT 59401

406.761.3010
tdhengineering.com

WORK PLAN
206 5TH STREET SOUTH – GREAT FALLS, MONTANA
GRANT NUMBER: BF95809510-0

CLIENT

Great Falls Development Authority
406 3rd Street NW, Suite 203
Great Falls, MT 59403
Attn: Lillian Sunwall

ENGINEER

TD&H Engineering
1800 River Drive North
Great Falls, MT 59401
Engineer: Peter Klevberg, PE

JOB NO. 21-035

FEBRUARY 2022

1800 River Drive North
Great Falls, MT 59401

TD&H Engineering

406.761.3010
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Sampling and Analysis Plan
206 5th Street South, Great Falls Montana
Project No. 21-035
Grant No. BF95809510-0

February 2022

Shen, Stephanie Digitally signed by Shen, Stephanie
Date: 2022.02.25 12:34:10 -07'00'

Stephanie Shen
Brownfields Project Manager
EPA Region 8

Date

Brandon Kingsbury
Petroleum Brownfields Coordinator
Montana Department of Environmental Quality

2/28/2022
Date

Lillian Sunwall, CPP
Vice President & Business Strategist
Great Falls Development Authority

2/28/2022
Date

Homer Corey League
Homer Corey League (Feb 28, 2022 09:17 MST)

H. Corey League, CHMM
Environmental Scientist
TD&H Engineering

Feb 28, 2022
Date

Peter Klevberg
Peter Klevberg (Feb 28, 2022 09:18 MST)

Peter Klevberg, PE
Project Manager / Q.A. Manager
TD&H Engineering

Feb 28, 2022
Date

TABLE OF CONTENTS

1. INTRODUCTION

This work plan is presented for a Phase II Environmental Site Assessment (ESA) at 206 5th Street South in Great Falls, Montana (Figure 1). The property is currently occupied by Bighorn Outdoor Specialists and James Company Realty. The proposed work will be conducted in accordance with the Programmatic Quality Assurance Project Plan (QAPP) February 2021 for the Brownfields Program of Great Falls Development Authority (GFDA), using procedures consistent with accepted standard operating procedures (SOPs) outline in the QAPP. Funding for the work would be partly granted to GFDA from the U.S. Environmental Protection Agency (EPA) Brownfields Program.

2. PROJECT BACKGROUND

TD&H Engineering (TD&H) completed a Phase I ESA on the property in February 2021. There are no known previous environmental site assessments performed on the property. As described in the Phase I, the property has consisted of a tire shop, was reportedly a gas station, and is now an outdoor recreational equipment store. No recognized environmental conditions (RECs) were uncovered during the TDH&H Phase I ESA; however, based on the historic use of the property as an automotive repair shop and a gas station, it is possible that soil contamination is present at the site.

The property consists of 0.344 acres (two city lots) and occupies the southwest corner of the intersection of Fifth Street South and Second Avenue South on the south side of downtown Great Falls, Montana. The east half of the property is a paved parking lot, while the west side is occupied by a single-story building, most of which houses the retail sales, storage, and shop areas of Bighorn Outdoor Specialists. The south end of the building is occupied by The James Company Realty, Inc. Topography is approximately flat and level.

3. PURPOSE

The purpose of the proposed Phase II ESA is to plug an existing data gap and evaluate whether soil contamination is present, as due diligence in support of financing for purchase and redevelopment of the property.

4. SCOPE OF WORK

To evaluate potential petroleum impacts to soil, the activities listed below will be performed in accordance with SOPs included in Appendix A of the 2021 GFDA Programmatic QAPP. Exhibit B from TD&H's scope of work presented in the November 3, 2021, Work Order is included below.

EXHIBIT B

SCOPE OF WORK

TD&H' will prepare a work plan with sampling and analysis plan (SAP), health and safety plan (HASP), and compile standard operating procedures (SOPs) per the programmatic *Quality Assurance Project Plan* (QAPP) for the Bighorn Outdoor Specialists site at 206 5th Street South

in Great Falls. TD&H will provide qualified drilling services and oversee soil borings, soil sampling, and data analysis as described in the work plan. A Phase II Environmental Site Assessment report will be generated based on the findings. The scope of work does include filing well logs with the Montana Bureau of Mines and Geology. The report will be produced in soft copy (pdf).

5. WORK PLAN

The first task is the preparation of this work plan, sampling, and analysis plan (SAP), and site-specific health and safety plan (HASP). The proposed Phase II ESA will include the following activities.

6. UTILITY LOCATE

Utilities can function as both potential receptors and as conduits for contaminant migration in the subsurface. A utility locate will be accomplished using the Montana Utility Notification Center prior to performing the subsurface investigation.

7. SUBSURFACE INVESTIGATION

The Phase I ESA uncovered information that the site had been used as an automotive repair facility and also dispensed gasoline for part of its history, though the fueling operation is unconfirmed. The underground storage tank was reportedly near the northeast corner of the site, and it was removed prior to regulation of buried fuel systems. Maintenance pits were present inside the building. The building now has a continuous concrete slab-on-grade floor with no pits or drains. Because of the fat clay soils that prevail in this part of Great Falls, it is likely that any drains that may have been present would have drained to a storage tank or the municipal sewer system. Leakage from these drains or the maintenance pits would likely be constrained by soil strata to only limited lateral or vertical migration.

To evaluate whether a subsurface release is present on the property, TD&H will conduct a single round of sampling at locations intended to bracket likely release areas on the property. The release areas are assumed to be associated with previous activities within the building. It is not feasible to investigate within the building due to clearance limitations and occupancy; therefore, TD&H will investigate at locations adjacent to the building and near the northeast corner of the property. As shown in red on Figure 2, four soil borings are proposed to be drilled using TD&H's Geoprobe 6610X rig. To evaluate subsurface conditions along the western half of the property building, it will be necessary to advance two of the soil borings on the west adjoining property that borders the site. The west adjoining property is currently occupied by The Great Falls Rescue Mission located at 408 2nd Avenue South. There is access on the eastern portion of the adjoining property that can allow the Geoprobe 6610X rig to advance two soil borings provided The Great Falls Rescue Mission grants authorization. The northeast boring is intended to intercept any contamination from the former fueling station that was reportedly at this location. The other borings are intended to intercept contamination that may have resulted from releases from drains or pits.

Soil samples will be collected continuously to a minimum depth of 10 feet and a maximum depth of 15 feet bgs in accordance with the SOP-9B contained herein. Samples will be selected for laboratory analysis based on olfactory and field headspace indications of contamination. If these are not apparent, then the sample from the bottom of the boring will be submitted to the laboratory.

Based on our knowledge of the local geology, we anticipate fat clay soils beneath the site. Ground water within ten feet of ground surface is not likely. However, if ground water is encountered, TD&H will measure the static water level in the boring, and soil samples will be collected at the ground water interface. TD&H's licensed monitoring well constructor can install a ground water monitoring well; however, this is not included in the present scope or budget. If ground water is encountered, TD&H will notify all parties and await direction before proceeding. If no obvious contamination is present and laboratory data indicate chemical concentrations below the risk-based screening levels, no additional action will be recommended. If soil samples collected at the ground water interface are greater than risk-based screening levels, additional investigation will be warranted.

Borings will be logged in accordance with SOP-9B by an experienced TD&H geologist or environmental technician. All four borings will be abandoned with bentonite chips.

8. DATA ANALYSIS AND VALIDATION

Both field and analytical data will be reviewed for accuracy and to confirm achievement of data quality objectives (DQOs) as described in the SAP. Completion of the Montana Department of Environmental Quality (DEQ) data validation form will be included in this process. This task will also include review of field activities for compliance with the SAP and QAPP, especially field tasks summarized below.

Field Tasks – Applicable Standard Operating Procedures
Bighorn Outdoor Specialists

Medium	Applicable SOPs	Comments
Soil	1, 2, 3, 4, 9B, 12, 16, 17	Applies to subsurface investigation.

As part of the data analysis task, results will be tabulated and compared with risk-based screening levels (RBSLs): Tier 1 RBSLs for soil, Tier 1 Soil Leaching (for applicable distance to ground water), Direct Contact Commercial, and Direct Contact Construction. The comparison of analytical data with relevant screening levels will be used to determine whether subsurface soils will require additional investigation or response actions consistent with the use of the property. If contamination is discovered in surface soils, then RBSLs for surface soil will apply as well.

9. RELEASE RESPONSE AND REPORTING

If a release or suspect release is discovered, then the release will be reported to DEQ within 24 hours of the discovery by calling (800) 457-0568.

If a release is suspected, then laboratory analytical data will be used to confirm the release. The owner/operator or contractor will confirm a release within 7 days from the date of receipt of laboratory analytical data.

TD&H will prepare a report providing documentation of all work tasks, compliance with the SAP and QAPP and referenced SOPs, comparison of data with DQOs and RBSLs, and presenting findings, conclusions, and recommendations. A figure will be prepared illustrating soil boring locations in addition to geographic information system (GIS) and electronic data deliverables (EDD) files per the SAP. The receptor survey will discuss possible impacts to all possible receptors, including ingestion/inhalation/dermal exposure to residents or workers, leaching to ground water, utilities intercepting the contamination, direct contact risk and/or discussion of why these receptors are or are not impacted. Whether site-specific clean-up standards should be developed depend on the results of the subsurface investigation. These topics will be addressed in the conclusions and recommendations sections of the report.

10. PROJECT ORGANIZATION AND STAFFING

Ms. Lillian Sunwall is the Brownfields Project Manager for GFDA and will review the overall quality of project deliverables submitted by TD&H. As project manager, Mr. Peter Klevberg (TD&H) will supervise contracted activities and work closely with project members to ensure the team meets deadlines and the project remains on budget. He will coordinate the work in cooperation with Ms. Sunwall and the EPA Brownfields Project Officer, Ms. Stephanie Shen. He will perform the quality assurance (Q.A.) manager functions for the project, including review of the draft report.

Directly supporting Mr. Klevberg are TD&H staff responsible for oversight and completion of field activities, data evaluation, reporting, and quality assurance and quality control (QA/QC). Mr. Corey League will be the environmental scientist responsible for field work, data analysis, and reporting. He will be assisted by support staff. TD&H Great Falls staff include three environmental technicians, as well as surveyors and clerical staff.

11. DISTRIBUTION LIST

This Work Plan will be distributed to TD&H staff working on the project and also to the following representatives of the GFDA and EPA.

Great Falls Development Authority
Attn: Lillian Sunwall
406 3rd Street NW, Suite 203
Great Falls, MT 59403

U.S. Environmental Protection Agency, Region 8
Attn: Stephanie Shen
1595 Wynkoop Street
Denver, CO 80202

Montana Department of Environmental Quality
Attn: Brandon Kingsbury | Petroleum Brownfields Coordinator

Contaminated Site Cleanup Bureau
PO Box 200901
Helena, MT 59620

The distribution of the Work Plan within these organizations will be the responsibility of designated representatives listed above.

12. PROJECT SCHEDULE

Pending prompt approval of this work plan, the following schedule may be maintained.

Project Schedule	
Task	**Completion Date**
Submittal of Work Plan	January 28, 2022
GFDA Approval of Work Plan	February 11, 2022
Agency Approval of Revised Work Plan	February 25, 2022
Implementation of Scope of Work	February 28, 2022
Receipt of Analytical Data	March 25, 2022
Submittal of Final Draft Report of Findings	April 15, 2022

The report will be provided in portable document format (pdf).

ACCEPTANCE

TD&H will schedule the work promptly following your acceptance and approval by regulators.

Sincerely,

Corey League *CHMM*
Environmental Scientist
TD&H ENGINEERING

Peter Klevberg *PE*
Project Manager / Q.A. Manager
TD&H ENGINEERING

APPENDIX A
FIGURES

N

SITE BOUNDARY

NOT FOR CONSTRUCTION

BIGHORN OUTDOOR SPECIALISTS
GREAT FALLS, MONTANA

VICINITY MAP

TD&H Engineering
tdhengineering.com

DRAWN BY:	DJK
DESIGNED BY:	
QUALITY CHECK:	
DATE:	2021-11-19
JOB NO.	21-035
CAD NO.	FIGURE 1

FIGURE
1

SOIL BORING LOCATION

SITE BOUNDARY

NOT FOR CONSTRUCTION

BIGHORN OUTDOOR SPECIALISTS
GREAT FALLS, MONTANA

PROPOSED SOIL BORING LOCATION MAP

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DRAWN BY:	DJK
DESIGNED BY:	
QUALITY CHECK:	
DATE:	2021-11-19
JOB NO.	21-035
CAD NO.	FIGURE 2

FIGURE
2

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APPENDIX B
SAMPLING AND ANALYSIS PLAN

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Objective of Site-Specific Sampling and Analysis Plan

This sampling and analysis plan (SAP) was written specifically for the Phase II investigation of the property located at 206 5th Street South in Great Falls, Montana (Figure 1). The property has historically consisted of a tire shop, a gas station, and is now an outdoor store. No recognized environmental conditions (RECs) were uncovered during the February 2021 TD&H Engineering (TD&H) Phase I Environmental Site Assessment (ESA); however, based on the historic use of the property as an automotive repair shop and a gas station, it is possible that soil contamination is present at the site. The purpose of the proposed Phase II ESA is to plug this data gap and evaluate whether soil contamination is present.

Table 1 - Site Specific Data Quality Objectives						
Step 1: Problem Statement	**Step 2: Identifying the Decisions**	**Step 3: Decision Inputs**	**Step 4: Study Boundaries**	**Step 5: Decision Rules**	**Step 6: Tolerance Limits on Errors**	**Step 7: Optimization of Sample Design**
Subsurface soil impacts may be present at this site. While no REC was discovered, data gaps exist. Subsurface soil impacts will be investigated in four locations on the site. This study will be conducted in order to address potential issues that may have an affect on the site from historical uses.	Are contaminants of potential concern (COPCs) present in subsurface soil? Are contaminants present at concentrations that would impact human health?	Subsurface soil samples will be collected continuously throughout the vadose zone and field analyzed for headspace organic vapor content. The field results will be used to select four samples to be submitted for laboratory analysis of COPCs. Soil data will be compared to Montana Department of Environmental Quality (DEQ) risk-based screening levels.	The study area is the property currently occupied by Bighorn Outdoor Specialists and James Company Realty. The site is located at 206 5th Street South in Great Falls, Montana, and measures 0.344 acres. The building occupies the western half of property. Parking occupies the eastern half of the property; 2nd Avenue North borders the property to the north, and 5th Street South borders the property to the east. The site is surrounded by commercial properties.	If concentrations of COPCs in soil are lower than applicable screening levels and/or standards, no additional actions are necessary. If soil results exceed screening levels and/or standards, corrective action mitigation measures will be proposed. If soil contamination is encountered and ground water is also encountered, then the scope will need to be increased to include at least one monitoring well.	Quality assurance and quality control procedures will be conducted and data validation will be performed in accordance with the programmatic QAPP for DEQ Brownfields Program.	The soil sampling strategy was designed to evaluate subsurface conditions on the west and east sides of the building to maximize spatial coverage and to include the likely former UST location at the northeast property corner.

Adequacy of Sampling

Petroleum hydrocarbons in the range covered by the test methods Extractable Petroleum Hydrocarbons (EPH) and Volatile Petroleum Hydrocarbons (VPH) are contaminants of potential concern (COPC).

A data gap exists for the soil medium. To adequately determine if a release has occurred at the site, three or four soil borings are required at approximately the locations shown on Figure 2. Up to three borings are to be advanced adjacent to the existing building and at least one boring near the northeast corner of the property. The soil boring plan is intended to bracket potential lateral and vertical subsurface contamination.

Sample Number and Analytical Methods

Sample number and analytical methods are shown in the table below, along with a comparison of typical laboratory reporting limits and screening levels in milligrams per kilogram (mg/kg) for soil samples.

Table 2
Soil Analytes, Reporting Limits, and Screening Levels

Target Analyte		Analytical Method	MDL (mg/kg)	PRL (mg/kg)	RBSL* (mg/kg)	Reporting Limit < Screening Level
Extractable Petroleum Hydrocarbons (EPH)	Aliphatic (C09-C18)	Massachusetts Method for EPH	5.50	10	540	Yes
	Aliphatic (C19-C36)		4.45	10	200,000	Yes
	Aromatic (C11-22)		4.60	10	370	Yes
	Total Extractable Hydrocarbons		19.5	10	200	Yes
Volatile Petroleum Hydrocarbons (VPH)	Aliphatic (C5-C8)	Massachusetts Method for VPH	0.325	2	220	Yes
	Aliphatic (C9-C12)		0.101	2	360	Yes
	Aromatic (C9-C10)		0.201	2	130	Yes
	Benzene		0.0102	0.05	0.07	Yes
	Ethylbenzene		0.0121	0.05	26	Yes
	Methyl-tert-butyl ether		0.0134	0.1	0.078	No
	Naphthalene		0.0192	0.1	12	Yes
	Toluene		0.00858	0.05	21	Yes
	Xylene (Total)		0.0365	0.05	310	Yes

Table 2
Soil Analytes, Reporting Limits, and Screening Levels

Target Analyte	Analytical Method	MDL (mg/kg)	PRL (mg/kg)	RBSL* (mg/kg)	Reporting Limit < Screening Level
Total Purgeable Hydrocarbons		0.415	2	100	Yes
1,2-Dibromoethane (EDB)	EPA SW8011	0.0002	0.0000823	0.000086	Yes
1,2-Dichloroethane (DCA)	EPA SW8260B	0.0338	0.2	0.019	No

Notes

Soil samples selected based on field screening with photoionization detector. For samples collected shallower than 2 feet below grade, see Table 1 (surface soil) for RBSLs.
MDL = Laboratory Method Detection Limit

PRL = Laboratory Reporting Limit

RBSL = Risk-Based Screening Level

mg/kg = milligrams per kilogram

*From Table 1-Tier 1 Subsurface Soil, < 10 feet to Ground Water, RBSLs and Standards - Montana Risk-Based Corrective Action Guidance for Petroleum Releases (May2018)

Analytical methods are the following:

- EPH – Extractable Petroleum Hydrocarbons by the Massachusetts Method
- VPH – Volatile Petroleum Hydrocarbons by the Massachusetts Method
- 1,2-Dicholoroethane (DCA) –EPA Method SW8260B
- 1,2-Dibromoethane (EDB) – EPA Method SW8011

In general, typical laboratory reporting limits are well below screening levels for the COPCs.

TD&H will select a laboratory ensuring the method detection limit and laboratory reporting limit are below the strictest residential leaching risk-based screening levels (RBSLs) for the soil analytes listed in the above table.

Based on experience at nearby sites, ground water is not anticipated. If ground water is encountered, the scope of services will need to be increased to include installation of at least one ground water monitoring well. This will require development and low-flow sampling. The water sample(s) will be analyzed for EPH, VPH; DCA, and EDB.

Sampling Procedures

Surficial soils will not be sampled except if contamination is present based on field screening. Subsurface soil samples will be collected continuously throughout the vadose zone. The samples will be split for field headspace analysis and possible laboratory analysis. All of the soil samples will be field analyzed for headspace organic vapor content and the field results used to select a total of four samples to be submitted for laboratory analysis, one from each boring. The work will be performed in accordance with standard operating procedures (SOPs) 1, 2, 3, 4, 9B, 12, 16, and 17.

If field evidence of contamination is encountered in a boring, an additional soil sample may be collected. The sample with the highest headspace organic vapor concentration will be submitted along with a sample from the apparent deepest extent of the contamination. For budgeting purposes, we have assumed that contamination will not be encountered, and only one soil sample per boring (plus one duplicate) will be submitted for laboratory analysis.

Based on our knowledge of the local geology, we anticipate fat clay soils beneath the site. Ground water within ten feet of ground surface is not likely. However, if ground water is encountered, TD&H will measure the static water level in the boring, and soil will be sampled at the ground water interface. If no obvious contamination is present and laboratory data indicate chemical concentrations below the risk-based screening levels, no additional action will be recommended. If soil samples collected at the ground water interface are greater than risk-based screening levels, additional investigation will be warranted. If ground water is encountered, installation of a monitoring well may be necessary. This would be a change in scope and would require prior approval before TD&H will proceed. The well would need to be developed following construction and prior to sampling in accordance with the Great Falls Development Authority (GFDA) Programmatic Quality Assurance Project Plan (QAPP) February 2021 SOP-10, SOP-11, and SOP-13. Sampling would be performed in accordance with the GFDA PQAPP SOP-8B.

Quality Control Samples

Field and laboratory quality control (QC) sampling will be completed in accordance with the GFDA QAPP SOP-16: “Quality Control Sampling,” this project-specific SAP, and the GFDA QAPP during the Phase II ESA. Quality control samples will consist of the following:

- Equipment blank for equipment used to collect soil samples
- Duplicate of one soil sample (fewer than 20 total soil samples)
- Trip blank and temperature blank as provided by the laboratory

The laboratory-provided trip blank and temperature blank samples will accompany the field samples in a single cooler.

Equipment

Field equipment will consist of the following:

- Photoionization detector (PID)
- Decontamination equipment
- Soil sampling hand tools (e.g. stainless-steel spoon)

Equipment is maintained by designated technicians. It will be visually inspected prior to loading for the field and on site prior to use. Calibration prior to use is per manufacturers' instructions.

Sample Handling

Sample identification and preservation are essential steps in the investigatory process. The holding times for soil samples without methanol preservation for VPH and EPH analyses are 7 and 14 days, respectively. Sample identification must be unique, traceable, and adequate to permit confident identification of sample location and that holding times have not been exceeded. Labeling of samples will be in accordance with SOP-3, "Sample Nomenclature, Documentation, and Chain-of-Custody Procedures." Packaging and shipment, as well as storage prior to shipping, will be in accordance with SOP-3 and SOP-4, "Sample Packaging and Shipping."

Laboratory Analysis

Energy Laboratories, Inc. (Energy) in Helena, Montana, is the laboratory selected to perform the analyses. Energy's quality control documentation is included in the QAPP.

Documentation

Field notes will be collected during all field activities per SOP-1, "Field Logbook and Field Sampling Forms." Information will be recorded by field personnel on field forms or in a field book using indelible ink. The notes will be made during the course of field activities.

For sample identification, the model nomenclature featured in SOP-3 will be followed. For example,

PR-1-5.0-5.5

would be a subsurface soil sample collected from the first boring from a depth of 5.0 to 5.5 feet below ground surface.

Chain-of-custody procedures as outlined in SOP-3 will be followed.

Field and laboratory data will be further documented using a figure and table during the reporting phase of the project and will be archived as described below.

Quality Control Review

Data quality control review occurs twice: first at the laboratory when the data are generated, and again when TD&H reviews the reports generated by the laboratory. Outliers are flagged in the reports and any deviations from the SAP noted. These deviations do not necessarily compromise the data quality objectives (DQOs) of the investigation; whether the DQOs are achieved must be ascertained by review of the quality control data. For example, if a sample result lies outside the DQOs for the laboratory analytical method but the reportable limit is still well below the screening level, then the result may be effective in accomplishing the purpose of the Phase II ESA. Data that do not permit conclusive comparison with screening levels do not satisfy the project DQOs.

Data Management

Data generated by the investigation will be entered into a geographic information system (GIS). In addition, field and laboratory data with project deliverables will be archived electronically as pdf (portable document format) files for a minimum of 10 years.

The DEQ has directed environmental consultants to prepare data in the form of electronic data deliverables (EDDs) for future entry into the DEQ's Treads Database. These files will be stored in a separate folder.

APPENDIX C
STANDARD OPERATING PROCEEDURE

Water & Environmental
TECHNOLOGIES

SOP-1

FIELD LOGBOOK AND FIELD SAMPLING FORMS

All pertinent field investigation and sampling information will be recorded on a field form during each day of the field effort and at each sample site. The field crew leader will be responsible for ensuring that sufficient detail is recorded on the field forms. No general rules can specify the extent of information that must be entered on the field form. However, field forms must contain sufficient information such that someone could reconstruct all field activities without relying on the memory of the field crew. All entries shall be made in indelible ink weather conditions permitting. Each day's or site's entries will be initialed and dated at the end by the author.

At a minimum, entries on the field sheet or in field notebook must include:

- Date and time of starting work and weather conditions.
- Names of field crew leader and team members.
- Project name and type.
- Description of site conditions and any unusual circumstances.
- Location of sample site, including map reference, if relevant.
- Details of actual work effort, particularly any deviations from the field work plan or standard operating procedures.
- Field observations.
- Any field measurements made (e.g., PID readings, pH, temperature).

For sampling efforts, specific details for each sample should be recorded using a standardized field form designed specifically for the sampling activity being conducted (ex., low-flow groundwater monitoring). Sampling field forms contain fill-in-the-blank type information in order that all pertinent information will be recorded. In addition to the items listed above, the following information is recorded on field forms during sampling efforts:

- Time and date samples were collected.
- Number and type (natural, duplicate, QA/QC) of samples collected.
- Analysis requested.
- Preservative added to samples.
- Sampling method, particularly deviations from standard operating procedures.

Strict custody procedures will be maintained with the field forms. Field forms must always remain with the field team while being used in the field. Upon completion of the field effort, photocopies of the original field forms will be made and used as working documents; original field forms will be filed in an appropriately secure manner.

Water & Environmental
TECHNOLOGIES

SOP-2

EQUIPMENT DECONTAMINATION

INTRODUCTION

The purpose of this section is to describe general decontamination procedures for field equipment. Decontamination will be performed on all nondedicated and non-disposable sampling equipment that may contact potentially contaminated media. Field personnel must wear disposable latex or nitrile gloves while decontaminating equipment at the project site and change gloves between every sample. Every precaution must be taken by personnel to prevent contaminating themselves with the wash water and rinse water used in the decontamination process.

EQUIPMENT

- 5-gallon plastic tubs
- Liquinox (detergent)
- 5-gallon plastic water containers
- Hard bristle brushes
- 5-gallon carboy containing deionized water
- Garbage bags
- 1-gallon cube of 10% HN03
- Latex or nitrile sample gloves
- 1-gallon container or spray bottle of 10%
- Methanol or pesticide grade Acetone for organics
- Spray bottles
- Paper towels
- Aluminum foil

PROCEDURES

The following should be done in order to complete thorough decontamination:

1. Set up the decontamination zone upwind from the sampling area to reduce the chances of wind borne contamination.
2. Visually inspect sampling equipment for contamination; use stiff brush to remove visible material.
3. The general decontamination sequence for field equipment includes wash with Liquinox or an equivalent degreasing detergent; deionized water rinse; 10% dilute nitric acid rinse; rinse with deionized water three times.
4. Rinse equipment with methanol in place of the nitric acid rinse if sampling for organic contamination. Follow with a deionized water rinse.
5. Decontaminated equipment that is used for sampling organics should be wrapped in aluminum foil if not used immediately.
6. Clean the outside of sample container after filling sample container.

Alternatively, field equipment can be decontaminated by steam cleaning, rinsing with 10% dilute nitric acid, and rinsing with deionized water.

All disposable items (e.g., paper towels, latex gloves), as well as rinse and wash water generated during decontamination, should be disposed in accordance with SOP-17 – Management of Investigation-Derived Waste.

Water & Environmental TECHNOLOGIES

SOP-3

SAMPLE NOMENCLATURE, DOCUMENTATION, AND CHAIN OF CUSTODY

INTRODUCTION

Sample documentation is an important step to ensure the laboratory, project manager, and field personnel are informed on the status of field samples. Depending on the specifics required for each project, several forms will need to be filled out. Most sample documentation forms are preprinted carbonless triplicates, enabling copies to be filled or mailed from labs or offices. The forms will be completed by field personnel, who have custody of the samples. The office copy will be kept in the project file and subsequent copies sent to the laboratory, or other designated parties.

Responsibility for completing the forms will be with each field crew leader. It is important the field crew leader is certain field personnel are familiar with the completion process for filling out forms, and the expected information is included.

Potential documents to be completed clearly in indelible ink for each sample generated include:

- Field Form
- Chain-of-Custody
- Custody Seal

A chain-of-custody form will be generated for all samples collected in the field for laboratory analysis. The sampler may use a project-specific chain-of-custody form or a chain-of-custody form provided by the laboratory.

FIELD EQUIPMENT

- Indelible ink pen
- Chain-of-custody forms
- Custody seals

PROCEDURES

Sample custody records must be maintained from the time of sample collection until the time of sample delivery to the analytical laboratory and should accompany the sample through analysis and final disposition. The information to be included on the chain-of¬ custody form will include, but is not limited to:

- Project number/site name
- Sampler's name and signature
- Date and time of sample collection
- Unique sample identification number or name
- Number of containers
- Sample media (e.g., soil, water, vapor, etc.)
- Sample preservative (if applicable)
- Requested analysis
- Comments or special instructions to the laboratory

Each sample will be assigned a unique sample identification number or name. The information on the chain-of-custody form, including the sample identification number or name, must correspond to the information recorded by the sampler on the field forms (refer to SOP 1) and the label on the sample container.

A sample is considered under a person's control when it is in their possession such that tampering is prevented. This includes placing the samples in an area of controlled access such as a building or locking the samples in a vehicle. When custody of a sample is relinquished by the sampler, the sampler will sign and date the chain-of-custody form and note the time that custody was relinquished.

The person receiving custody of the sample will also sign and date the form and note the time that the sample was accepted into custody. Samples will be shipped to the analytical laboratory following the procedures in SOP 4. If an overnight shipping service is used to transport the samples to the laboratory, custody of the samples will be relinquished to the shipping service. The shipping service will not sign the chain-of-custody form; however, the samples can be tracked while in the custody of the shipping service. More than one sample may be included on a chain-of-custody form, as long as all of the samples are for the same project. Copies of the chain-of-custody form will be maintained in the project file, in accordance with standardized or project-specific data management procedures.

Water & Environmental
TECHNOLOGIES

SOP-4

SAMPLE PACKAGE AND SHIPPING

PACKAGING

All environmental samples collected should be packaged and shipped using the following procedures:

1. Label all sample containers with indelible ink (on the side, not on the cap or lid). Place labeled sample bottles in a high-quality cooler containing an adequate amount of ice (sealed inside two Ziploc bags) to maintain a temperature of 4°C or less inside the cooler. Freeze packs, or "Blue Ice" is NOT to be used. Ensure the cooler drain plug is taped shut.
2. Place the samples in an upright position and wrap the samples with absorbent, cushioning material for stability during transport. Samples should not be loose; the cooler should be able to withstand tough handling during shipment without sample breakage.
3. Fill out the appropriate shipping forms and place in a Ziploc bag then tape it to the inside lid of the shipping container. Shipping forms usually consist of a chain-of-custody form, which documents the samples included in the shipment and specifies the laboratory analyses for each sample.

Note - A chain-of-custody form should be totally unique to a single cooler or shipping container. A cooler should only contain samples that are listed on the chain-of-custody form inside that cooler, and the chain-of-custody form should not list any samples that are not in that particular cooler. For large sample efforts requiring samples be shipped in two or more coolers, DO NOT fill out a single chain-of-custody form for the entire set of samples and place multiple copies of the same form in multiple coolers. Place only one chain-of-custody in one of the coolers.

4. Close and seal the cooler using strapping tape.
5. Place completed sample custody seals on the cooler such that the seals will be broken when the cooler is opened. The custody seal must contain, at minimum, the signature of the person relinquishing custody of the samples and the date the cooler is sealed. Secure the custody seals on the cooler with clear strapping tape.
6. Secure the shipping label with address, phone number, and return address clearly visible.

SHIPPING HAZARDOUS MATERIALS/WASTE

Hazardous materials need to be shipped using procedures specified under Federal Law. Samples need to be shipped in Ziploc bags or paint cans filled with packing material, depending on the level of hazard. Special package labeling may be needed. Consult the project manager for specific shipping procedures.

Water & Environmental TECHNOLOGIES

SOP-9B

SOIL, SEDIMENT, AND ROCK SAMPLING

SUBSURFACE SOIL SAMPLING – Borehole and Excavation

The purpose of this section is to provide procedures which may be employed in a subsurface sampling program to obtain samples of materials that are: (1) representative of subsurface conditions at the site, (2) appropriate to the types of analyses to be performed, and (3) cost effective toward meeting goals of the project. Sampling may consist of either a general survey or detailed exploration and may often encompass both. A general survey is designed to obtain preliminary information about subsurface conditions such as depth to rock and soil classification.

Borehole Sampling

Equipment

- Drill rig and associated drilling and sampling equipment as specified in project specific work plans.
  -Hollow stem auger
  -Air-rotary casing hammer
  -Dual tube percussion hammer
  -Sonic
  -Cable tool
  -Mud rotary
  -Reverse rotary
  -Direct push technology
- Continuous-core barrels.
- Split-spoon drive sampler.
- Large capacity stainless steel borehole bailer.
- Photoionization detector (PID) or flame ionization detector (FID).
- Sample containers (laboratory-supplied).
- Sample labels, pens, and field logbook or appropriate field forms (e.g., boring and well con struction logs).
- Personnel and equipment decontamination supplies.
- Sample shipping and packaging supplies.

Procedures

1. Obtain applicable drilling and well construction permits prior to mobilization.
2. Mark boring locations specified in the project-specific sampling and analysis plans (SAPs). Sampling locations may need to be relocated based on presence of underground utilities (see Procedure 3). Invasive activities may not begin until utility marking is complete or notification from the utility company has been received that marking is unnecessary.

3. Clear sample locations for underground utilities and structures by notifying Montana's one-call notification center (1-800-424-5555) (required) at least 2, but not more than 10 business days prior to commencement of field activities. In addition, contact knowledgeable site operations personnel and use a private utility locator service (if necessary) to identify possible underground utilities.
4. Select appropriate drilling technology. If placing conductor/isolation casing, select the appropriate construction methods based on lithologic conditions and chemicals of concern and using best industry practices. As needed, methodologies will be addressed in site-specific work plans.
5. Utilize pre-cleaned downhole equipment or decontaminate/steam clean downhole equipment prior to drilling each boring.
6. Collect soil samples for lithologic logging purposes with a split-spoon sampler, continuous coring system, or appropriate sampler as specified in the project-specific sampling and analysis plans (SAPs).
7. Collect soil samples for lithologic logging and chemical and physical analyses by driving the appropriate sampling device at the desired depth. If sampling is being conducted for geotechnical purposes, the appropriate sampling device, appurtenances, and procedures will be used (e.g., standard penetration testing, thin wall tube sampling, oriented coring, etc.).
8. When advancing borings with air-driven drilling rigs (e.g., air-rotary or reverse circulation percussion hammer), soil samples for lithologic observation and logging (not geotechnical or analytical testing) may be collected from the cyclone discharge.
9. Classify the soils in the field in general accordance with the visual-manual procedure of the Unified Soil Classification System (ASTM D-2488-90). The Munsell Color Classification may also be used.
10. Prior to collecting each sample, decontaminate the sampling equipment in accordance with the SOP-2.
11. At each sampling interval, place a sufficient volume of soil into laboratory-supplied sample containers (typically glass jars). The number and volume of the sample containers required for each sample is dependent on the analytical method(s).
12. Place completed sample label on the sample containers.
13. If the project sampling and analysis plan calls for field screening of VOCs using a photoionization detector, for each sampling interval, place soil not selected for chemical analysis in an airtight container (e.g., plastic bag) and collect headspace readings in accordance with SOP-12. Record the headspace concentration in the field logbook or appropriate field forms.

Backhoe or Hand Dug Excavations

Equipment

- Backhoe with appropriately sized bucket (supplied by contractor)
- Stainless steel or plastic scoop
- Hand-driven split-spoon sampler
- Brass or stainless-steel liners
- Rubber mallet
- Stakes, flagging, or spray paint for sampling grid
- Measuring tape and/or measuring wheel
- Sample containers (laboratory-supplied)
- Sample labels, pens, field logbook and or other appropriate field forms (e.g., test pit log)
- Personnel and equipment decontamination supplies
- Sample shipping and packaging supplies

Procedures

1. Identify and mark the test pit location(s). Invasive activities may not begin until utility marking is complete or notification from the utility company has been received that marking is unnecessary.
2. Identify overhead obstructions and underground utilities that may interfere with the backhoe excavation.
3. Clear test pit locations for underground utilities and structures by notifying Montana's one-call notification center (1-800-424-5555) (required) at least 2 but not more than 10 business days prior to commencement of field activities. In addition, contact knowledgeable site operations personnel and use a private utility locator service (if necessary) to identify possible underground utilities.
4. Excavate the test pit to the desired depth and length using the backhoe. Excavator bucket will be decontaminated between test pit locations by either brushing off residual soil and/or steam cleaning. Actual sampling depths and locations will vary from test pit to test pit, as described in the project-specific sampling and analysis plans (SAPs). Collect the sample by either driving a split-spoon sampler into the unearthed material, driving a brass or stainless-steel liner with a rubber mallet into the material, or collecting a representative sample using a stainless steel or plastic scoop. In any case, collect the sample in a way that will minimize headspace in the sample container. Where possible and practicable, subsurface soil samples will be collected from the test pit sidewalls and/or excavation floor using a hand auger or similar device without entering the excavation. If attempts to retrieve a sample using a hand auger or similar device fail, then a sample may be collected from the excavator bucket.

NOTE: Field personnel will not enter a test pit unless a detailed hazard assessment has been conducted and adequate safety equipment is used during excavation.

5. Record the physical and lithologic conditions of the test pit and sampling location within the test pit in the field logbook or other appropriate field forms (i.e., test pit log).
6. If no visible indications of contamination are present, backfill the excavation with the material removed or backfill and compact with imported clean fill. If visible indications of contamination are present, cover or otherwise secure the test pit pending decisions from Project Manager regarding appropriate backfilling procedures. Contaminated soil from an excavation will be placed on an appropriate liner, bermed, and covered with an impermeable cover pending decisions from the Project Manager regarding appropriate sampling/handling/disposal.

Water & Environmental TECHNOLOGIES

SOP-12

PROCEDURES FOR FIELD SCREENING USING A PHOTOIONIZATION DETECTOR

This guideline describes the procedures typically followed during operation of a photoionization detector (PID).

EQUIPMENT

- RAE Systems model Plus Classic or equivalent
- Calibration gas with regulator, tubing, and Tedlar® bag
- Locking storage bags or pint plastic jars with aluminum foil covering
- Toolkit
- Operations manual
- Spare batteries
- Pens, field logbook, and/or appropriate field forms

PROCEDURES

Calibrate PID at the office prior to commencement of field activities to check instrument is in proper working order. At a minimum, calibrate before use each day (or more frequently as necessary) as indicated below. The initial daily calibration may be performed at the office (if located in proximity to the site), motel, or in the field.

1. Check the battery charge level. If in doubt, charge the battery as described in the manual. The battery should typically be recharged daily after use.
2. Turn unit on. Do not look into the sensor (ultraviolet radiation hazard). The probe or pump should make an audible sound (whine or solid tone) confirming operation.
3. Perform zero and calibration procedures as described in the operating manual. Calibration can be performed for specific compounds so that the instrument response is proportional to the calibration gas concentration. If typical isobutylene calibrant is utilized; the instrument manual provides response factors for other compounds. Note: Verify that the ionizing lamp in the PID is suitable for the compounds being evaluated. Consult the table below, or the operator's manual for ionization potentials and response factors for common compounds. A PID is not suitable for detecting methane. The instrument should be calibrated under ambient conditions to account for temperature and humidity. Use instrument manufacturer designed moisture trap on probe when testing saturated soil or water samples.
4. Once calibrated, the unit is ready for use. Position the intake assembly close to the area in question because the sampling rate allows only for localized readings.
5. A slow, sweeping motion of the intake assembly helps to prevent the bypassing of problem areas.
6. For ambient air monitoring, set the alarm at the desired level. Be prepared to evacuate the work area if the preset alarm sounds.
7. For soil monitoring, use the headspace method below:
   a. Place a consistent amount of soil into a sealable plastic bag (i.e., approximately 100 grams of soil).
   b. Seal the plastic bag.

c. Wait a consistent amount to time (typically several minutes).
d. Open the bag slightly, insert the intake assembly into bag, and observe the peak reading. Static voltage sources, such as power lines, radio transmissions, or transformers, may interfere with measurements. Consult the operating manual for a discussion of necessary considerations.

8. Record the measurements on the field logbook or other appropriate field form.

SPECIAL NOTES

Read the operator's manual thoroughly. As with any field instrument, accurate results depend on the operator being completely familiar with the unit. Be aware that moisture may affect readings. Clean and maintain the instrument and accessories to obtain representative readings.

In the event the instrument must be shipped via a courier service (i.e., UPS, FedEx, etc.) from the office to a field location, ship the instrument (including calibration gas) via ground in accordance with Department of Transportation regulations and courier service requirements.

PID Lamp Selection

LAMP	DESCRIPTION	TYPICAL COMPOUNDS DETECTED
9.BeV	Most selective lamp	Benzene, aromatic, compounds, amines
10.6eV	Standard PID lamp	All compounds detected by 9.8 eV lamp and chlorinated compounds, including vinyl chloride, DCE, TCE, PCE, and chlorobenzene
11.7 eV	Detects broadest range of analytes	All compounds detected by 10.6 eV lamp, used to detect methylene chloride, carbon tetrachloride, chloroform, 1, 1, 1-trichloroethane

Water & Environmental
TECHNOLOGIES

SOP-16

QUALITY CONTROL SAMPLING

Quality Control (QC) samples are submitted along with natural samples to provide supporting laboratory data to validate laboratory results. QC samples are submitted blind with the exception of matrix spikes and trip blanks, and do not have any unique identifying codes that would enable the lab or others to bias these samples in any way. Usually, the time or sampling location is modified in a way which will separate blank and standard samples from the rest of the sample train. QC samples are identified only on field forms and in field notebooks. The following codes are typically used:

N	Natural Sample	Soil, water, air, or other of interest material from a field site
SP	Split Sample	A portion of a natural sample collected for independent analysis; used in calculating laboratory precision
D	Duplicate Sample	Two samples taken from the same media under similar conditions; also used to calculate precision
FB	Field Blank	Deionized water collected in sample bottle; used to detect contamination introduced during the sampling process.
RB	Rinsate Blank	Deionized water run through or over decontaminated equipment; used to verify the effectiveness of equipment decontamination procedures
MS/MSD	Matrix Spike / Matrix Spike Duplicate	Certified materials of known concentration; used to assess Spike Duplicate laboratory precision and accuracy
TB	Trip Blank	Inert material (deionized water or diatomaceous earth) included in sample cooler; sent by the lab, the sample is used to detect any contamination or cross-contamination during handling and transportation.

In general, selected QC samples will be inserted into the sample train within a group of twenty samples. QC samples will be prepared in the field with the exception of trip blanks, and matrix spike/matrix spike duplicate samples. Trip blanks will be supplied by the laboratory and will accompany each sample cooler containing samples for analysis of volatile organic compounds. Matrix spike and matrix spike duplicates will be generated by submitting three duplicate samples from the same sample to the laboratory. The laboratory will then spike two of the three samples with known concentrations of select target compounds. After the laboratory has spiked the matrix spike and matrix spike duplicate samples, they are subject to the same laboratory procedures and analyses as all other samples collected during the investigation.

Typical QC sample collection frequencies are presented in the table below. Refer to the project-specific sampling and analysis plan or quality assurance plan for the appropriate QC sample frequency. Each field crew leader will be responsible for all QC samples prepared by that crew.

QC SAMPLE	PURPOSE	COLLECTION FREQUENCY
Field Duplicate	Measure analytical precision	1 per every 20 samples
Matrix Spike / Matrix Spike Duplicate	Measure analytical accuracy	1 per every 20 samples
Equipment rinse blanks	Evaluate effectiveness of equipment decontamination and sample handling procedures.	1 per sampling event per media type
Field Blank	Assess possible cross-contamination of samples due to ambient conditions during sample collection	1 per sampling event
Trip Blank	Evaluate sample preservation, packing, shipping, and storage	1 per cooler containing samples with volatile constituents

Methods for computing data validation statements can be found in EPA documents or obtained from Geomatrix.

Water & Environmental
TECHNOLOGIES

SOP-17

MANAGEMENT OF INVESTIGATION-DERIVED WASTE

INTRODUCTION

This SOP describes the management of investigation-derived waste (IDW). The project specific Sampling and Analysis Plan should be referenced for additions or deletions to the methods noted below.

EQUIPMENT

- Department of Transportation (DOT)-approved packaging (typically DOT 17E or 17H drums) or other appropriate containers
- Funnel
- Bushing wrench
- 15/16-inch socket wrench
- Shovel
- Appropriate markers (spray paint, paint pen) and labels
- Plastic sheeting
- Drip pans
- Pallets
- Personal protective equipment as specified in the Site-Specific Health and Safety Plan (HASP).

PROCEDURES

Preparing Containers

1. Place each container on a pallet if it is to be moved with a forklift after it is full.
2. Ensure that packaging materials are compatible with the wastes to be stored in them. Bung-type drums should be used to contain liquids. If a liquid is corrosive, a plastic or polymer drum should be used.
3. Solids should be placed in open-top drums. Liners are placed in the drums if the solid material is corrosive or contains free liquids (other than water). Gaskets are also used on open-top drum lids.

Known or Assumed Non-Hazardous Waste

1. As waste materials are generated, place them directly into storage containers. Alternatively, depending on quantity, soils may be contained onsite on plastic sheeting and covered pending analytical results. In certain instances, if it is known that the IDW is not hazardous, it can be disposed of onsite (e.g., dispose the purge water on the ground, place soils back into test pits).
2. If the IDW is placed into a container, do not fill storage containers/drums completely. Provide sufficient space so that containers will not be overfull if their contents expand.
3. After filling a storage container/drum, seal it securely. Use a bung wrench or socket wrench, for a bung-type or open-top drum, respectively.

4. Label the container indicating its content, date, and origin/location.
5. If it is known that the IDW is not hazardous, arrange for disposal of the IDW as a solid waste.
6. If no information exists as to determine whether the IDW is hazardous (e.g., records, analytical results, of other knowledge of the IDW properties), the IDW must be profiled to determine disposal options.
7. To profile the waste:
   a. Contact the proposed disposal facility to obtain the type of information the disposal facility will need before accepting the IDW, including necessary analytical data. Note: The disposal facility will rely on you to provide information regarding the types of constituents that may be present in the IDW.
   b. If analytical data are needed, collect a sample or samples of the IDW and submit to an analytical laboratory.
8. Upon receiving the analytical results, arrange for the proper disposal of the IDW.

Hazardous Wastes

1. As waste materials are generated, place them directly into storage containers.
2. Do not fill storage containers/drums completely. Provide sufficient space for expansion.
3. After filling a storage container/drum, seal it securely. Use a bung wrench or socket wrench, for abung-type or open-top drum, respectively.
4. Label drums or other packages containing hazardous waste. To comply with marking and labeling requirements, affix a properly filled out yellow hazardous waste marker. Do not mark drums with Water & Environmental Technologies' name. All waste belongs to the client. Include the accumulation start date on the label.
5. During an ongoing investigation, use a paint marker to mark the contents, station number, date, and approximate quantity of material on each drum or other container.
6. Do not mix IDW with one another or with other materials. Do not place items such as Tyvek® suits, gloves, equipment, or trash into drums containing soils or liquids, and do not mix water and soil. Disposable protective clothing, trash, soil, and water materials should be disposed of in separate containers.
7. Place the containers in a secured area equipped with a secondary containment system, if appropriate.
8. While storing the IDW, the substantive standards in 40 Code of Federal Regulation (CFR) Parts 264 and 265 Subparts I and J or State equivalent must be complied with.
9. Dispose the IDW upon completion of the field work or incorporate the IDW into the remedial action upon initiation of the final remedy. If the IDW will be disposed offsite, the IDW will need to be manifested for transportation in accordance with federal or state requirements.

Superfund Requirements

Testing and management of IDW originating from within a Superfund area, such as operable of the Butte/Anaconda NPL Sites, must be addressed in Site-Specific SAPs.

REFERENCE

Montana Department of Environmental Quality. (Undated). Technical Guidance Document #10 - Options for Discharge of Hydrocarbon-Contaminated Wastewater. Montana Department of Environmental Quality, Remediation Division, Petroleum Release Section, Helena, Montana.

APPENDIX B
Soil Boring Logs

GRAPHIC LOG	SURFACE: asphaltic pavement SURFACE ELEVATION: SOIL DESCRIPTION	DEPTH (FT)	GROUND WATER	SPT BLOW COUNTS	SAMPLE
	Asphaltic PAVEMENT	0.6			
	Poorly-Graded SAND, appears medium dense, fine grained, brown, moist HS = 2.0 ppm	4.0			
	Poorly-Graded GRAVEL, angular (fill), moist HS = 0.0 ppm	4.2			
	Sandy Lean CLAY, appears stiff, brown, very moist to wet	7.0			
	Fat CLAY, appears stiff, brown, very moist; occasional alkali salts on fractures, swells in sample tube HS = 1.0 ppm HS = 0.2 ppm sample for laboratory analysis 14-15 ft. bgs. HS = 0.7 ppm	15.0			
	Bottom of Boring	Ground water not encoun-tered			

PENETRATION RESISTANCE/MOISTURE CONTENT

● = MOISTURE CONTENT
▲ = BLOWS PER FOOT

DEPTH (FT): 0, 2.5, 5, 7.5, 10, 12.5, 15, 17.5

0 10 20 30 40 50

LEGEND

- ▲ SPT blows per foot
- ● Field Moisture content
- ▼ Groundwater Level
- Grab/composite sample
- 1-3/8-inch I.D. split spoon
- 2-1/2-inch I.D. split spoon
- 2-1/2-inch I.D. ring sampler
- 3-inch I.D. thin-walled sampler
- * No sample recovery

Atterberg Limits

Plastic Limit
In-Situ Water Content
Liquid Limit
Plasticity Index

GNP = Granular and Nonplastic

Note: The stratification lines represent approximate boundaries between soil types. Actual boundaries may be gradual or transitional.

LOG OF SOIL BORING BHO-1

G.F.D.A. Brownfields
Bighorn Outdoor Specialists

Logged by: H.C. League

Drilled by: TD&H Engineering / C. Nadeau Geoprobe 6610X Direct Push

11 March 2022 21-035

TD&H THOMAS, DEAN & HOSKINS, INC.
ENGINEERING CONSULTANTS
GREAT FALLS–BOZEMAN–KALISPELL–HELENA
SPOKANE LEWISTON
MONTANA WASHINGTON IDAHO

Figure No.

Sheet 1 of 1

GRAPHIC LOG	SURFACE: asphaltic pavement SURFACE ELEVATION: SOIL DESCRIPTION	DEPTH (FT)	GROUND WATER	SPT BLOW COUNTS	SAMPLE
	Asphaltic PAVEMENT	0.5			
	Poorly-Graded SAND, appears medium dense, fine grained, brown, moist; a few small roots HS = 0.0 ppm	4.0			
	Fat CLAY with Sand, appears stiff, brown, very moist; sand stringers in clay, a few gypsum mottles, sample swells in tube HS = 0.0 ppm HS = 0.0 ppm sample for laboratory analysis 14.5-15.0 ft. bgs. HS = 0.0 ppm	15.0			
	Bottom of Boring	Ground water not encoun-tered			

PENETRATION RESISTANCE/MOISTURE CONTENT

● = MOISTURE CONTENT
▲ = BLOWS PER FOOT

DEPTH (FT): 0, 2.5, 5, 7.5, 10, 12.5, 15, 17.5

0 10 20 30 40 50

LEGEND

- ▲ SPT blows per foot
- ● Field Moisture content
- Groundwater Level
- Grab/composite sample
- 1-3/8-inch I.D. split spoon
- 2-1/2-inch I.D. split spoon
- 2-1/2-inch I.D. ring sampler
- 3-inch I.D. thin-walled sampler
- * No sample recovery

Atterberg Limits

Plastic Limit
In-Situ Water Content
Liquid Limit
Plasticity Index

GNP = Granular and Nonplastic

Note: The stratification lines represent approximate boundaries between soil types. Actual boundaries may be gradual or transitional.

LOG OF SOIL BORING BHO-2

G.F.D.A. Brownfields
Bighorn Outdoor Specialists

Logged by: H.C. League

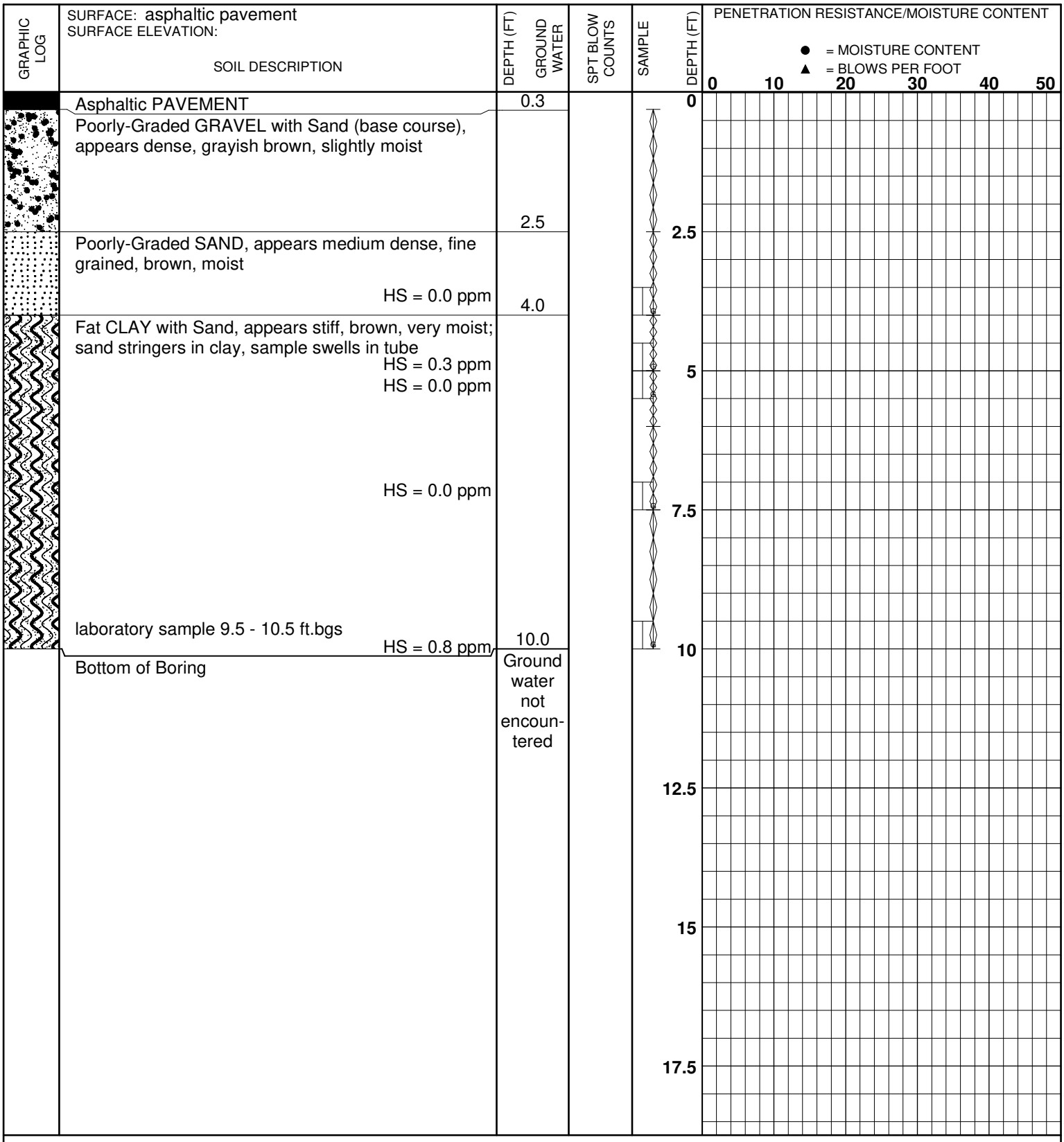
Drilled by: TD&H Engineering / C. Nadeau Geoprobe 6610X Direct Push

11 March 2022 21-035

TD&H THOMAS, DEAN & HOSKINS, INC.
ENGINEERING CONSULTANTS
GREAT FALLS–BOZEMAN–KALISPELL–HELENA
SPOKANE LEWISTON
MONTANA WASHINGTON IDAHO

Figure No.

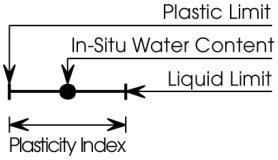
Sheet 1 of 1



LEGEND

- ▲ SPT blows per foot
- ● Field Moisture content
- Groundwater Level
- Grab/composite sample
- 1-3/8-inch I.D. split spoon
- 2-1/2-inch I.D. split spoon
- 2-1/2-inch I.D. ring sampler
- 3-inch I.D. thin-walled sampler
- * No sample recovery

Atterberg Limits



GNP = Granular and Nonplastic

Note: The stratification lines represent approximate boundaries between soil types. Actual boundaries may be gradual or transitional.

LOG OF SOIL BORING BHO-3

G.F.D.A. Brownfields
Bighorn Outdoor Specialists

Logged by: H.C. League

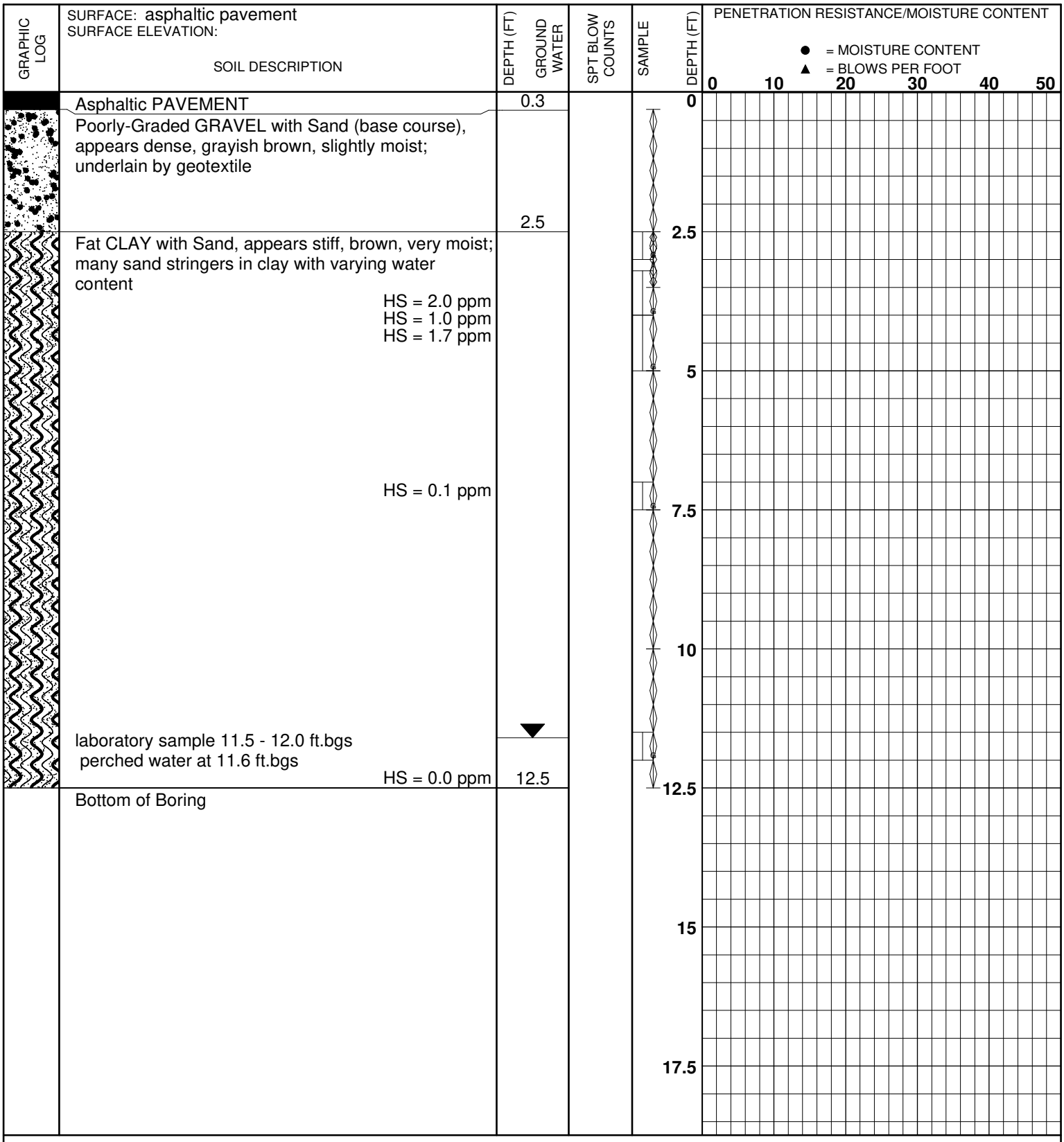
Drilled by: TD&H Engineering / C. Nadeau Geoprobe 6610X Direct Push

11 March 2022 21-035

TD&H THOMAS, DEAN & HOSKINS, INC. ENGINEERING CONSULTANTS
GREAT FALLS–BOZEMAN–KALISPELL–HELENA MONTANA
SPOKANE LEWISTON WASHINGTON IDAHO

Figure No.

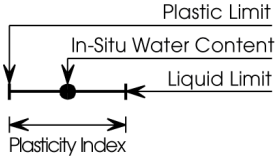
Sheet 1 of 1



LEGEND

- ▲ SPT blows per foot
- ● Field Moisture content
- Groundwater Level
- Grab/composite sample
- 1-3/8-inch I.D. split spoon
- 2-1/2-inch I.D. split spoon
- 2-1/2-inch I.D. ring sampler
- 3-inch I.D. thin-walled sampler
- * No sample recovery

Atterberg Limits



GNP = Granular and Nonplastic

Note: The stratification lines represent approximate boundaries between soil types. Actual boundaries may be gradual or transitional.

LOG OF SOIL BORING BHO-4

G.F.D.A. Brownfields
Bighorn Outdoor Specialists

Logged by: H.C. League

Drilled by: TD&H Engineering / C. Nadeau Geoprobe 6610X Direct Push

11 March 2022 21-035

TD&H THOMAS, DEAN & HOSKINS, INC. ENGINEERING CONSULTANTS
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SPOKANE WASHINGTON
LEWISTON IDAHO

Figure No.

Sheet 1 of 1

APPENDIX C
Laboratory Analytical Report

ANALYTICAL SUMMARY REPORT

March 31, 2022

TD and H Engineering
1800 River Dr N
Great Falls, MT 59401-1301

Work Order: H22030372

Project Name: 21-035

Energy Laboratories Inc Helena MT received the following 5 samples for TD and H Engineering on 3/15/2022 for analysis.

Lab ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
H22030372-001	BH-1 [14.0-15.0]	03/11/22 9:40	03/15/22	Solid	EPH-Ultrasonic Extraction SW3550C Methanol Extraction for Volatiles SW5035 Hydrocarbons, Extractable Petroleum-Scrn Volatile Petroleum Hydrocarbons Percent Moisture EDB & EDC in soil by ECD Prep SW8011 for EDB & EDC by ECD Soil Preparation USDA1 Volatile Organics, Methanol Extraction SW5035 8260-VOCs, Low Level - Short List
H22030372-002	BH-2 [14.5-15]	03/11/22 11:00	03/15/22	Solid	EPH-Ultrasonic Extraction SW3550C Methanol Extraction for Volatiles SW5035 Hydrocarbons, Extractable Petroleum-Scrn Volatile Petroleum Hydrocarbons Percent Moisture EDB & EDC in soil by ECD Prep SW8011 for EDB & EDC by ECD Volatile Organics, Methanol Extraction SW5035 8260-VOCs, Low Level - Short List
H22030372-003	BH-3 [9.5-10.0]	03/11/22 12:00	03/15/22	Solid	Same As Above
H22030372-004	BH-4 [11.5-12.0]	03/11/22 13:00	03/15/22	Solid	Same As Above
H22030372-005	Field Duplicate	03/11/22 13:00	03/15/22	Solid	Same As Above

The analyses presented in this report were performed by Energy Laboratories, Inc., 3161 E. Lyndale Ave., Helena, MT 59604, unless otherwise noted. Any exceptions or problems with the analyses are noted in the report package. Any issues encountered during sample receipt are documented in the Work Order Receipt Checklist.

The results as reported relate only to the item(s) submitted for testing. This report shall be used or copied only in its entirety. Energy Laboratories, Inc. is not responsible for the consequences arising from the use of a partial report.

If you have any questions regarding these test results, please contact your Project Manager.

Report Approved By:

CLIENT: TD and H Engineering
Project: 21-035
Work Order: H22030372

Report Date: 03/31/22

CASE NARRATIVE

Tests associated with analyst identified as ELI-B were subcontracted to Energy Laboratories, 1120 S. 27th St., Billings, MT, EPA Number MT00005.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: TD and H Engineering
Project: 21-035
Lab ID: H22030372-001
Client Sample ID: BH-1 [14.0-15.0]

Report Date: 03/31/22
Collection Date: 03/11/22 09:40
DateReceived: 03/15/22
Matrix: Solid

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Moisture	31.4	wt%		0.2		D2974	03/15/22 15:59 / jjp
VOLATILE ORGANIC COMPOUNDS							
1,2-Dichloroethane	ND	mg/kg-dry		0.0073	0.019	SW8260B	03/21/22 16:28 / tmj
Surr: p-Bromofluorobenzene	93.0	%REC		81-144		SW8260B	03/21/22 16:28 / tmj
Surr: Dibromofluoromethane	94.0	%REC		67-138		SW8260B	03/21/22 16:28 / tmj
Surr: 1,2-Dichloroethane-d4	81.0	%REC		68-138		SW8260B	03/21/22 16:28 / tmj
Surr: Toluene-d8	97.0	%REC		76-145		SW8260B	03/21/22 16:28 / tmj
VOCS BY MICROEXTRACTION-ECD							
1,2-Dibromoethane	ND	mg/kg-dry		0.00029	9E-05	SW8011	03/23/22 02:19 / eli-b
Surr: 1,1,1,2-Tetrachloroethane	112	%REC		50-150		SW8011	03/23/22 02:19 / eli-b
PETROLEUM HYDROCARBONS-VOLATILE (VPH)							
Methyl tert-butyl ether (MTBE)	ND	mg/kg-dry		0.15	0.078	MA-VPH	03/18/22 04:24 / GMS
Benzene	ND	mg/kg-dry		0.073	0.07	MA-VPH	03/18/22 04:24 / GMS
Toluene	ND	mg/kg-dry		0.073	21	MA-VPH	03/18/22 04:24 / GMS
Ethylbenzene	ND	mg/kg-dry		0.073	6.4	MA-VPH	03/18/22 04:24 / GMS
m+p-Xylenes	ND	mg/kg-dry		0.073		MA-VPH	03/18/22 04:24 / GMS
o-Xylene	ND	mg/kg-dry		0.073		MA-VPH	03/18/22 04:24 / GMS
Xylenes, Total	ND	mg/kg-dry		0.073	72	MA-VPH	03/18/22 04:24 / GMS
Naphthalene	ND	mg/kg-dry		0.15	2.2	MA-VPH	03/18/22 04:24 / GMS
C9 to C10 Aromatics	ND	mg/kg-dry		2.9	130	MA-VPH	03/18/22 04:24 / GMS
C5 to C8 Aliphatics	ND	mg/kg-dry		2.9	52	MA-VPH	03/18/22 04:24 / GMS
C9 to C12 Aliphatics	ND	mg/kg-dry		2.9	77	MA-VPH	03/18/22 04:24 / GMS
Total Purgeable Hydrocarbons	ND	mg/kg-dry		2.9	100	MA-VPH	03/18/22 04:24 / GMS
Surr: VPH Aromatics Surrogate	86.0	%REC		70-130		MA-VPH	03/18/22 04:24 / GMS
Surr: VPH Aliphatics Surrogate	91.0	%REC		70-130		MA-VPH	03/18/22 04:24 / GMS
- Note 1: The C5 to C8 Aliphatics value is corrected for aromatic constituents Benzene and Toluene.							
- Note 2: The C9 to C12 Aliphatics value is corrected for aromatic constituents Ethylbenzene, m+p-Xylenes, o-Xylene and C9 to C10 Aromatics.							
EXTRACTABLE PETROLEUM HYDROCARBONS-SCREEN ANALYSIS							
Total Extractable Hydrocarbons	ND	mg/kg-dry		24	200	SW8015M	03/22/22 01:00 / jdh
Surr: o-Terphenyl	107	%REC		40-140		SW8015M	03/22/22 01:00 / jdh
- Note: Total Extractable Hydrocarbons are defined as the total hydrocarbon responses regardless of elution time.							

Report Definitions:
RL - Analyte Reporting Limit
QCL - Quality Control Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: TD and H Engineering
Project: 21-035
Lab ID: H22030372-002
Client Sample ID: BH-2 [14.5-15]

Report Date: 03/31/22
Collection Date: 03/11/22 11:00
DateReceived: 03/15/22
Matrix: Solid

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Moisture	30.7	wt%		0.2		D2974	03/15/22 15:59 / jjp
VOLATILE ORGANIC COMPOUNDS							
1,2-Dichloroethane	ND	mg/kg-dry		0.0072	0.019	SW8260B	03/21/22 18:34 / tmj
Surr: p-Bromofluorobenzene	86.0	%REC		81-144		SW8260B	03/21/22 18:34 / tmj
Surr: Dibromofluoromethane	91.0	%REC		67-138		SW8260B	03/21/22 18:34 / tmj
Surr: 1,2-Dichloroethane-d4	75.0	%REC		68-138		SW8260B	03/21/22 18:34 / tmj
Surr: Toluene-d8	96.0	%REC		76-145		SW8260B	03/21/22 18:34 / tmj
VOCS BY MICROEXTRACTION-ECD							
1,2-Dibromoethane	ND	mg/kg-dry		0.00029	9E-05	SW8011	03/23/22 01:00 / eli-b
Surr: 1,1,1,2-Tetrachloroethane	115	%REC		50-150		SW8011	03/23/22 01:00 / eli-b
PETROLEUM HYDROCARBONS-VOLATILE (VPH)							
Methyl tert-butyl ether (MTBE)	ND	mg/kg-dry		0.14	0.078	MA-VPH	03/18/22 04:57 / GMS
Benzene	ND	mg/kg-dry		0.072	0.07	MA-VPH	03/18/22 04:57 / GMS
Toluene	ND	mg/kg-dry		0.072	21	MA-VPH	03/18/22 04:57 / GMS
Ethylbenzene	ND	mg/kg-dry		0.072	6.4	MA-VPH	03/18/22 04:57 / GMS
m+p-Xylenes	ND	mg/kg-dry		0.072		MA-VPH	03/18/22 04:57 / GMS
o-Xylene	ND	mg/kg-dry		0.072		MA-VPH	03/18/22 04:57 / GMS
Xylenes, Total	ND	mg/kg-dry		0.072	72	MA-VPH	03/18/22 04:57 / GMS
Naphthalene	ND	mg/kg-dry		0.14	2.2	MA-VPH	03/18/22 04:57 / GMS
C9 to C10 Aromatics	ND	mg/kg-dry		2.9	130	MA-VPH	03/18/22 04:57 / GMS
C5 to C8 Aliphatics	ND	mg/kg-dry		2.9	52	MA-VPH	03/18/22 04:57 / GMS
C9 to C12 Aliphatics	ND	mg/kg-dry		2.9	77	MA-VPH	03/18/22 04:57 / GMS
Total Purgeable Hydrocarbons	ND	mg/kg-dry		2.9	100	MA-VPH	03/18/22 04:57 / GMS
Surr: VPH Aromatics Surrogate	83.0	%REC		70-130		MA-VPH	03/18/22 04:57 / GMS
Surr: VPH Aliphatics Surrogate	90.0	%REC		70-130		MA-VPH	03/18/22 04:57 / GMS
- Note 1: The C5 to C8 Aliphatics value is corrected for aromatic constituents Benzene and Toluene.							
- Note 2: The C9 to C12 Aliphatics value is corrected for aromatic constituents Ethylbenzene, m+p-Xylenes, o-Xylene and C9 to C10 Aromatics.							
EXTRACTABLE PETROLEUM HYDROCARBONS-SCREEN ANALYSIS							
Total Extractable Hydrocarbons	ND	mg/kg-dry		14	200	SW8015M	03/22/22 01:47 / jdh
Surr: o-Terphenyl	110	%REC		40-140		SW8015M	03/22/22 01:47 / jdh
- Note: Total Extractable Hydrocarbons are defined as the total hydrocarbon responses regardless of elution time.							

Report Definitions:
RL - Analyte Reporting Limit
QCL - Quality Control Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: TD and H Engineering
Project: 21-035
Lab ID: H22030372-003
Client Sample ID: BH-3 [9.5-10.0]

Report Date: 03/31/22
Collection Date: 03/11/22 12:00
DateReceived: 03/15/22
Matrix: Solid

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Moisture	26.8	wt%		0.2		D2974	03/15/22 15:59 / jjp
VOLATILE ORGANIC COMPOUNDS							
1,2-Dichloroethane	ND	mg/kg-dry		0.0068	0.019	SW8260B	03/21/22 19:06 / tmj
Surr: p-Bromofluorobenzene	81.0	%REC		81-144		SW8260B	03/21/22 19:06 / tmj
Surr: Dibromofluoromethane	81.0	%REC		67-138		SW8260B	03/21/22 19:06 / tmj
Surr: 1,2-Dichloroethane-d4	72.0	%REC		68-138		SW8260B	03/21/22 19:06 / tmj
Surr: Toluene-d8	84.0	%REC		76-145		SW8260B	03/21/22 19:06 / tmj
VOCS BY MICROEXTRACTION-ECD							
1,2-Dibromoethane	ND	mg/kg-dry		0.00027	9E-05	SW8011	03/23/22 01:20 / eli-b
Surr: 1,1,1,2-Tetrachloroethane	116	%REC		50-150		SW8011	03/23/22 01:20 / eli-b
PETROLEUM HYDROCARBONS-VOLATILE (VPH)							
Methyl tert-butyl ether (MTBE)	ND	mg/kg-dry		0.14	0.078	MA-VPH	03/18/22 05:30 / GMS
Benzene	ND	mg/kg-dry		0.068	0.07	MA-VPH	03/18/22 05:30 / GMS
Toluene	ND	mg/kg-dry		0.068	21	MA-VPH	03/18/22 05:30 / GMS
Ethylbenzene	ND	mg/kg-dry		0.068	6.4	MA-VPH	03/18/22 05:30 / GMS
m+p-Xylenes	ND	mg/kg-dry		0.068		MA-VPH	03/18/22 05:30 / GMS
o-Xylene	ND	mg/kg-dry		0.068		MA-VPH	03/18/22 05:30 / GMS
Xylenes, Total	ND	mg/kg-dry		0.068	72	MA-VPH	03/18/22 05:30 / GMS
Naphthalene	ND	mg/kg-dry		0.14	2.2	MA-VPH	03/18/22 05:30 / GMS
C9 to C10 Aromatics	ND	mg/kg-dry		2.7	130	MA-VPH	03/18/22 05:30 / GMS
C5 to C8 Aliphatics	ND	mg/kg-dry		2.7	52	MA-VPH	03/18/22 05:30 / GMS
C9 to C12 Aliphatics	ND	mg/kg-dry		2.7	77	MA-VPH	03/18/22 05:30 / GMS
Total Purgeable Hydrocarbons	ND	mg/kg-dry		2.7	100	MA-VPH	03/18/22 05:30 / GMS
Surr: VPH Aromatics Surrogate	83.0	%REC		70-130		MA-VPH	03/18/22 05:30 / GMS
Surr: VPH Aliphatics Surrogate	89.0	%REC		70-130		MA-VPH	03/18/22 05:30 / GMS
- Note 1: The C5 to C8 Aliphatics value is corrected for aromatic constituents Benzene and Toluene.							
- Note 2: The C9 to C12 Aliphatics value is corrected for aromatic constituents Ethylbenzene, m+p-Xylenes, o-Xylene and C9 to C10 Aromatics.							
EXTRACTABLE PETROLEUM HYDROCARBONS-SCREEN ANALYSIS							
Total Extractable Hydrocarbons	ND	mg/kg-dry		14	200	SW8015M	03/22/22 04:09 / jdh
Surr: o-Terphenyl	103	%REC		40-140		SW8015M	03/22/22 04:09 / jdh
- Note: Total Extractable Hydrocarbons are defined as the total hydrocarbon responses regardless of elution time.							

Report Definitions:
RL - Analyte Reporting Limit
QCL - Quality Control Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: TD and H Engineering
Project: 21-035
Lab ID: H22030372-004
Client Sample ID: BH-4 [11.5-12.0]

Report Date: 03/31/22
Collection Date: 03/11/22 13:00
DateReceived: 03/15/22
Matrix: Solid

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Moisture	27.7	wt%		0.2		D2974	03/15/22 15:59 / jjp
VOLATILE ORGANIC COMPOUNDS							
1,2-Dichloroethane	ND	mg/kg-dry		0.0069	0.019	SW8260B	03/21/22 19:38 / tmj
Surr: p-Bromofluorobenzene	79.0	%REC	S	81-144		SW8260B	03/21/22 19:38 / tmj
Surr: Dibromofluoromethane	77.0	%REC		67-138		SW8260B	03/21/22 19:38 / tmj
Surr: 1,2-Dichloroethane-d4	74.0	%REC		68-138		SW8260B	03/21/22 19:38 / tmj
Surr: Toluene-d8	80.0	%REC		76-145		SW8260B	03/21/22 19:38 / tmj
VOCS BY MICROEXTRACTION-ECD							
1,2-Dibromoethane	ND	mg/kg-dry		0.00027	9E-05	SW8011	03/23/22 01:40 / eli-b
Surr: 1,1,1,2-Tetrachloroethane	114	%REC		50-150		SW8011	03/23/22 01:40 / eli-b
PETROLEUM HYDROCARBONS-VOLATILE (VPH)							
Methyl tert-butyl ether (MTBE)	ND	mg/kg-dry		0.14	0.078	MA-VPH	03/18/22 06:02 / GMS
Benzene	ND	mg/kg-dry		0.069	0.07	MA-VPH	03/18/22 06:02 / GMS
Toluene	ND	mg/kg-dry		0.069	21	MA-VPH	03/18/22 06:02 / GMS
Ethylbenzene	ND	mg/kg-dry		0.069	6.4	MA-VPH	03/18/22 06:02 / GMS
m+p-Xylenes	ND	mg/kg-dry		0.069		MA-VPH	03/18/22 06:02 / GMS
o-Xylene	ND	mg/kg-dry		0.069		MA-VPH	03/18/22 06:02 / GMS
Xylenes, Total	ND	mg/kg-dry		0.069	72	MA-VPH	03/18/22 06:02 / GMS
Naphthalene	ND	mg/kg-dry		0.14	2.2	MA-VPH	03/18/22 06:02 / GMS
C9 to C10 Aromatics	ND	mg/kg-dry		2.8	130	MA-VPH	03/18/22 06:02 / GMS
C5 to C8 Aliphatics	ND	mg/kg-dry		2.8	52	MA-VPH	03/18/22 06:02 / GMS
C9 to C12 Aliphatics	ND	mg/kg-dry		2.8	77	MA-VPH	03/18/22 06:02 / GMS
Total Purgeable Hydrocarbons	ND	mg/kg-dry		2.8	100	MA-VPH	03/18/22 06:02 / GMS
Surr: VPH Aromatics Surrogate	82.0	%REC		70-130		MA-VPH	03/18/22 06:02 / GMS
Surr: VPH Aliphatics Surrogate	86.0	%REC		70-130		MA-VPH	03/18/22 06:02 / GMS
- Note 1: The C5 to C8 Aliphatics value is corrected for aromatic constituents Benzene and Toluene.							
- Note 2: The C9 to C12 Aliphatics value is corrected for aromatic constituents Ethylbenzene, m+p-Xylenes, o-Xylene and C9 to C10 Aromatics.							
EXTRACTABLE PETROLEUM HYDROCARBONS-SCREEN ANALYSIS							
Total Extractable Hydrocarbons	ND	mg/kg-dry		13	200	SW8015M	03/22/22 04:56 / jdh
Surr: o-Terphenyl	101	%REC		40-140		SW8015M	03/22/22 04:56 / jdh
- Note: Total Extractable Hydrocarbons are defined as the total hydrocarbon responses regardless of elution time.							

Report Definitions:
RL - Analyte Reporting Limit
QCL - Quality Control Limit
S - Spike recovery outside of advisory limits
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: TD and H Engineering
Project: 21-035
Lab ID: H22030372-005
Client Sample ID: Field Duplicate

Report Date: 03/31/22
Collection Date: 03/11/22 13:00
DateReceived: 03/15/22
Matrix: Solid

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Moisture	26.7	wt%		0.2		D2974	03/15/22 16:00 / jjp
VOLATILE ORGANIC COMPOUNDS							
1,2-Dichloroethane	ND	mg/kg-dry		0.0068	0.019	SW8260B	03/21/22 20:09 / tmj
Surr: p-Bromofluorobenzene	83.0	%REC		81-144		SW8260B	03/21/22 20:09 / tmj
Surr: Dibromofluoromethane	83.0	%REC		67-138		SW8260B	03/21/22 20:09 / tmj
Surr: 1,2-Dichloroethane-d4	73.0	%REC		68-138		SW8260B	03/21/22 20:09 / tmj
Surr: Toluene-d8	88.0	%REC		76-145		SW8260B	03/21/22 20:09 / tmj
VOCS BY MICROEXTRACTION-ECD							
1,2-Dibromoethane	ND	mg/kg-dry		0.00027	9E-05	SW8011	03/23/22 02:00 / eli-b
Surr: 1,1,1,2-Tetrachloroethane	113	%REC		50-150		SW8011	03/23/22 02:00 / eli-b
PETROLEUM HYDROCARBONS-VOLATILE (VPH)							
Methyl tert-butyl ether (MTBE)	ND	mg/kg-dry		0.14	0.078	MA-VPH	03/18/22 06:35 / GMS
Benzene	ND	mg/kg-dry		0.068	0.07	MA-VPH	03/18/22 06:35 / GMS
Toluene	ND	mg/kg-dry		0.068	21	MA-VPH	03/18/22 06:35 / GMS
Ethylbenzene	ND	mg/kg-dry		0.068	6.4	MA-VPH	03/18/22 06:35 / GMS
m+p-Xylenes	ND	mg/kg-dry		0.068		MA-VPH	03/18/22 06:35 / GMS
o-Xylene	ND	mg/kg-dry		0.068		MA-VPH	03/18/22 06:35 / GMS
Xylenes, Total	ND	mg/kg-dry		0.068	72	MA-VPH	03/18/22 06:35 / GMS
Naphthalene	ND	mg/kg-dry		0.14	2.2	MA-VPH	03/18/22 06:35 / GMS
C9 to C10 Aromatics	ND	mg/kg-dry		2.7	130	MA-VPH	03/18/22 06:35 / GMS
C5 to C8 Aliphatics	ND	mg/kg-dry		2.7	52	MA-VPH	03/18/22 06:35 / GMS
C9 to C12 Aliphatics	ND	mg/kg-dry		2.7	77	MA-VPH	03/18/22 06:35 / GMS
Total Purgeable Hydrocarbons	ND	mg/kg-dry		2.7	100	MA-VPH	03/18/22 06:35 / GMS
Surr: VPH Aromatics Surrogate	87.0	%REC		70-130		MA-VPH	03/18/22 06:35 / GMS
Surr: VPH Aliphatics Surrogate	92.0	%REC		70-130		MA-VPH	03/18/22 06:35 / GMS
- Note 1: The C5 to C8 Aliphatics value is corrected for aromatic constituents Benzene and Toluene.							
- Note 2: The C9 to C12 Aliphatics value is corrected for aromatic constituents Ethylbenzene, m+p-Xylenes, o-Xylene and C9 to C10 Aromatics.							
EXTRACTABLE PETROLEUM HYDROCARBONS-SCREEN ANALYSIS							
Total Extractable Hydrocarbons	ND	mg/kg-dry		13	200	SW8015M	03/22/22 05:43 / jdh
Surr: o-Terphenyl	107	%REC		40-140		SW8015M	03/22/22 05:43 / jdh
- Note: Total Extractable Hydrocarbons are defined as the total hydrocarbon responses regardless of elution time.							

Report Definitions:
RL - Analyte Reporting Limit
QCL - Quality Control Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: TD and H Engineering **Work Order:** H22030372 **Report Date:** 03/31/22

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **D2974**									Batch: PMOIST_220315_B	
Lab ID: **H22030372-002A DUP**	Sample Duplicate					Run: SOIL DRYING OVEN 2_22031			03/15/22 15:59	
Moisture		32.1	wt%	0.20				4.4	20	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: TD and H Engineering **Work Order:** H22030372 **Report Date:** 03/31/22

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: MA-VPH										Batch: 60495
Lab ID: MB-60495	14	Method Blank				Run: GC3_220317A				03/18/22 00:02
Methyl tert-butyl ether (MTBE)		ND	mg/kg-dry	0.10						
Benzene		ND	mg/kg-dry	0.050						
Toluene		ND	mg/kg-dry	0.050						
Ethylbenzene		ND	mg/kg-dry	0.050						
m+p-Xylenes		ND	mg/kg-dry	0.050						
o-Xylene		ND	mg/kg-dry	0.050						
Naphthalene		ND	mg/kg-dry	0.10						
C9 to C10 Aromatics		ND	mg/kg-dry	2.0						
C5 to C8 Aliphatics		ND	mg/kg-dry	2.0						
C9 to C12 Aliphatics		ND	mg/kg-dry	2.0						
Total Purgeable Hydrocarbons		ND	mg/kg-dry	2.0						
Xylenes, Total		ND	mg/kg-dry	0.050						
Surr: VPH Aromatics Surrogate				0.050	95	70	130			
Surr: VPH Aliphatics Surrogate				0.050	110	70	130			
Lab ID: LCS-60495	14	Laboratory Control Sample				Run: GC3_220317A				03/18/22 00:34
2-Methylpentane		2.36	mg/kg-dry	0.10	94	70	130			
n-Butylcyclohexane		2.42	mg/kg-dry	0.10	97	70	130			
n-Decane		2.71	mg/kg-dry	0.10	108	70	130			
n-Pentane		2.24	mg/kg-dry	0.10	90	30	130			
Methyl tert-butyl ether (MTBE)		2.05	mg/kg-dry	0.10	82	70	130			
Benzene		2.15	mg/kg-dry	0.050	86	70	130			
Toluene		2.24	mg/kg-dry	0.050	89	70	130			
Ethylbenzene		2.35	mg/kg-dry	0.050	94	70	130			
m+p-Xylenes		4.63	mg/kg-dry	0.050	93	70	130			
o-Xylene		2.30	mg/kg-dry	0.050	92	70	130			
Naphthalene		2.22	mg/kg-dry	0.10	89	70	130			
Total Purgeable Hydrocarbons		36.2	mg/kg-dry	2.0	96	70	130			
Surr: VPH Aromatics Surrogate				0.050	96	70	130			
Surr: VPH Aliphatics Surrogate				0.050	101	70	130			
Lab ID: H22030296-012AMS	10	Sample Matrix Spike				Run: GC3_220317A				03/18/22 02:13
Methyl tert-butyl ether (MTBE)		2.61	mg/kg-dry	0.11	92	70	130			
Benzene		2.69	mg/kg-dry	0.057	94	70	130			
Toluene		2.78	mg/kg-dry	0.057	98	70	130			
Ethylbenzene		2.92	mg/kg-dry	0.057	102	70	130			
m+p-Xylenes		5.69	mg/kg-dry	0.057	100	70	130			
o-Xylene		2.83	mg/kg-dry	0.057	99	70	130			
Naphthalene		2.73	mg/kg-dry	0.11	96	70	130			
Total Purgeable Hydrocarbons		44.4	mg/kg-dry	2.3	104	70	130			
Surr: VPH Aromatics Surrogate				0.057	102	70	130			
Surr: VPH Aliphatics Surrogate				0.057	105	70	130			
Lab ID: H22030296-012AMSD	10	Sample Matrix Spike Duplicate				Run: GC3_220317A				03/18/22 02:46
Methyl tert-butyl ether (MTBE)		2.62	mg/kg-dry	0.11	92	70	130	0.3	20	
Benzene		2.65	mg/kg-dry	0.057	93	70	130	1.3	20	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: TD and H Engineering **Work Order:** H22030372 **Report Date:** 03/31/22

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **MA-VPH**										Batch: 60495
Lab ID: **H22030296-012AMSD**	10	Sample Matrix Spike Duplicate				Run: GC3_220317A				03/18/22 02:46
Toluene		2.73	mg/kg-dry	0.057	96	70	130	1.8	20	
Ethylbenzene		2.86	mg/kg-dry	0.057	100	70	130	2.1	20	
m+p-Xylenes		5.53	mg/kg-dry	0.057	97	70	130	3.0	20	
o-Xylene		2.75	mg/kg-dry	0.057	96	70	130	2.8	20	
Naphthalene		2.64	mg/kg-dry	0.11	93	70	130	3.3	20	
Total Purgeable Hydrocarbons		41.4	mg/kg-dry	2.3	97	70	130	6.9	20	
Surr: VPH Aromatics Surrogate				0.057	102	70	130			
Surr: VPH Aliphatics Surrogate				0.057	101	70	130			
Method: **MA-VPH**										Analytical Run: R173036
Lab ID: **CCV_0316GC337r-S**	15	Continuing Calibration Verification Standard								03/17/22 08:32
1,2,4-Trimethylbenzene		2.40	mg/kg-dry	0.10	96	75	125			
2,2,4-Trimethylpentane		2.18	mg/kg-dry	0.10	87	75	125			
2-Methylpentane		2.13	mg/kg-dry	0.10	85	75	125			
n-Butylcyclohexane		1.93	mg/kg-dry	0.10	77	75	125			
n-Decane		1.88	mg/kg-dry	0.10	75	75	125			
n-Pentane		1.95	mg/kg-dry	0.10	78	75	125			
Methyl tert-butyl ether (MTBE)		2.17	mg/kg-dry	0.10	87	75	125			
Benzene		2.22	mg/kg-dry	0.050	89	75	125			
Toluene		2.34	mg/kg-dry	0.050	93	75	125			
Ethylbenzene		2.44	mg/kg-dry	0.050	98	75	125			
m+p-Xylenes		4.88	mg/kg-dry	0.050	98	75	125			
o-Xylene		2.45	mg/kg-dry	0.050	98	75	125			
Naphthalene		2.40	mg/kg-dry	0.10	96	75	125			
Surr: VPH Aromatics Surrogate				0.050	90	70	130			
Surr: VPH Aliphatics Surrogate				0.050	97	70	130			

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: TD and H Engineering **Work Order:** H22030372 **Report Date:** 03/31/22

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW8011										Analytical Run: B_164748
Lab ID: CK3-164748	2	Continuing Calibration Verification Standard								03/22/22 23:01
1,2-Dibromoethane		0.0118	mg/kg	0.00020	118	70	130			
Surr: 1,1,1,2-Tetrachloroethane				0.0010	105	70	130			
Lab ID: CK5-164748	2	Continuing Calibration Verification Standard								03/23/22 03:39
1,2-Dibromoethane		0.0463	mg/kg	0.00020	116	70	130			
Surr: 1,1,1,2-Tetrachloroethane				0.0010	119	70	130			
Method: SW8011										Batch: B_164748
Lab ID: MB-164748	2	Method Blank				Run: SUB-B376635				03/22/22 23:21
1,2-Dibromoethane		ND	mg/kg	0.00020						
Surr: 1,1,1,2-Tetrachloroethane				0.0010	114	50	150			
Lab ID: LCS-164748	2	Laboratory Control Sample				Run: SUB-B376635				03/22/22 23:41
1,2-Dibromoethane		0.0237	mg/kg	0.00020	118	50	150			
Surr: 1,1,1,2-Tetrachloroethane				0.0010	113	50	150			
Lab ID: H22030372-001A	2	Sample Matrix Spike				Run: SUB-B376635				03/23/22 02:39
1,2-Dibromoethane		0.0260	mg/kg-dry	0.00028	92	50	150			
Surr: 1,1,1,2-Tetrachloroethane				0.0014	109	50	150			
Lab ID: H22030372-001A	2	Sample Matrix Spike Duplicate				Run: SUB-B376635				03/23/22 02:59
1,2-Dibromoethane		0.0253	mg/kg-dry	0.00029	88	50	150	2.7	40	
Surr: 1,1,1,2-Tetrachloroethane				0.0014	101	50	150			

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: TD and H Engineering **Work Order:** H22030372 **Report Date:** 03/31/22

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW8015M										Batch: 60514
Lab ID: MB-60514	2	Method Blank				Run: HHP2_220317A				03/18/22 12:00
Total Extractable Hydrocarbons		ND	mg/kg-dry	10						
Surr: o-Terphenyl				0.17	106	40	140			
Lab ID: LCS-60514	2	Laboratory Control Sample				Run: HHP2_220321A				03/22/22 00:13
Total Extractable Hydrocarbons		246.0	mg/kg-dry	10	115	60	140			
Surr: o-Terphenyl				0.17	117	40	140			
Lab ID: H22030372-002AMS	2	Sample Matrix Spike				Run: HHP2_220321A				03/22/22 02:34
Total Extractable Hydrocarbons		337.3	mg/kg-dry	14	110	60	140			
Surr: o-Terphenyl				0.24	111	40	140			
Lab ID: H22030372-002AMSD	2	Sample Matrix Spike Duplicate				Run: HHP2_220321A				03/22/22 03:22
Total Extractable Hydrocarbons		317.6	mg/kg-dry	14	103	60	140	6.0	20	
Surr: o-Terphenyl				0.24	106	40	140			
Method: SW8015M										Batch: 60547
Lab ID: MB-60547	2	Method Blank				Run: HHP2_220321A				03/21/22 22:38
Total Extractable Hydrocarbons		ND	mg/kg-dry	10						
Surr: o-Terphenyl				0.17	110	40	140			
Lab ID: LCS-60547	2	Laboratory Control Sample				Run: HHP2_220321A				03/21/22 23:26
Total Extractable Hydrocarbons		242.5	mg/kg-dry	10	114	60	140			
Surr: o-Terphenyl				0.17	115	40	140			
Lab ID: H22030396-025AMS	2	Sample Matrix Spike				Run: HHP2_220322A				03/22/22 23:46
Total Extractable Hydrocarbons		403.2	mg/kg-dry	12	105	60	140			
Surr: o-Terphenyl				0.20	100	40	140			
Lab ID: H22030396-025AMSD	2	Sample Matrix Spike Duplicate				Run: HHP2_220324A				03/25/22 08:46
Total Extractable Hydrocarbons		406.6	mg/kg-dry	12	106	60	140	0.8	20	
Surr: o-Terphenyl				0.20	109	40	140			

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: TD and H Engineering **Work Order:** H22030372 **Report Date:** 03/31/22

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **SW8015M**										Analytical Run: R173123
Lab ID: **CCV_0321GC413r-S**	15	Continuing Calibration Verification Standard								03/21/22 21:51
n-Nonane		6.950	mg/kg-dry		104	75	125			
n-Decane		6.968	mg/kg-dry		105	75	125			
n-Dodecane		6.598	mg/kg-dry		99	75	125			
n-Tetradecane		6.841	mg/kg-dry		103	75	125			
n-Hexadecane		6.054	mg/kg-dry		91	75	125			
n-Octadecane		6.469	mg/kg-dry		97	75	125			
n-Nonadecane		6.593	mg/kg-dry		99	75	125			
n-Eicosane		6.593	mg/kg-dry		99	75	125			
n-Docosane		6.495	mg/kg-dry		97	75	125			
n-Tetracosane		6.473	mg/kg-dry		97	75	125			
n-Hexacosane		6.485	mg/kg-dry		97	75	125			
n-Octacosane		6.502	mg/kg-dry		98	75	125			
n-Triacontane		6.158	mg/kg-dry		92	75	125			
n-Hexatriacontane		6.404	mg/kg-dry		96	75	125			
Surr: o-Terphenyl				0.17	98	75	125			

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: TD and H Engineering **Work Order:** H22030372 **Report Date:** 03/31/22

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW8260B										Batch: 60502
Lab ID: LCS-60502	5	Laboratory Control Sample				Run: 5973MSD_220321A				03/21/22 13:22
1,2-Dichloroethane		0.222	mg/kg	0.0050	89	51	140			
Surr: p-Bromofluorobenzene					104	81	144			
Surr: Dibromofluoromethane					105	67	138			
Surr: 1,2-Dichloroethane-d4					92	68	138			
Surr: Toluene-d8					121	76	145			
Lab ID: MB-60502	5	Method Blank				Run: 5973MSD_220321A				03/21/22 14:25
1,2-Dichloroethane		ND	mg/kg	0.0050						
Surr: p-Bromofluorobenzene					105	81	141			
Surr: Dibromofluoromethane					107	76	138			
Surr: 1,2-Dichloroethane-d4					97	68	138			
Surr: Toluene-d8					115	76	145			
Lab ID: H22030372-001AMS	5	Sample Matrix Spike				Run: 5973MSD_220321A				03/21/22 16:59
1,2-Dichloroethane		0.347	mg/kg-dry	0.0073	95	51	140			
Surr: p-Bromofluorobenzene					83	81	144			
Surr: Dibromofluoromethane					87	67	138			
Surr: 1,2-Dichloroethane-d4					76	68	138			
Surr: Toluene-d8					90	76	145			
Lab ID: H22030372-001AMSD	5	Sample Matrix Spike Duplicate				Run: 5973MSD_220321A				03/21/22 17:31
1,2-Dichloroethane		0.361	mg/kg-dry	0.0073	99	51	140	4.0	20	
Surr: p-Bromofluorobenzene					82	81	144			
Surr: Dibromofluoromethane					87	67	138			
Surr: 1,2-Dichloroethane-d4					75	68	138			
Surr: Toluene-d8					93	76	145			
Method: SW8260B										Analytical Run: R173104
Lab ID: 21-Mar-22_CCV_4	5	Continuing Calibration Verification Standard								03/21/22 12:38
1,2-Dichloroethane		0.185	mg/kg	0.0050	74	70	130			
Surr: p-Bromofluorobenzene					98	70	130			
Surr: Dibromofluoromethane					103	70	130			
Surr: 1,2-Dichloroethane-d4					91	70	130			
Surr: Toluene-d8					116	70	130			

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

BH-1 Batch ID: 60514

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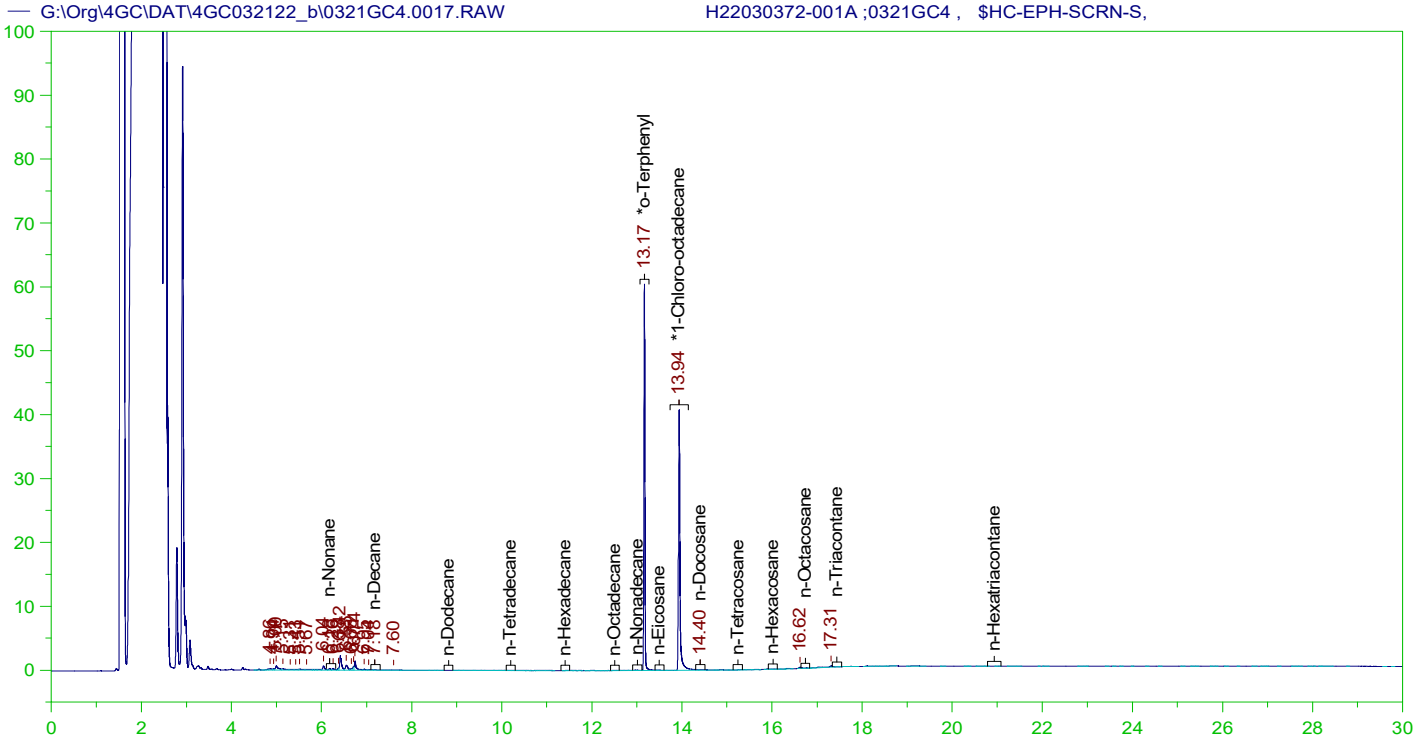

EXTRACTABLE PETROLEUM HYDROCARBONS (EPH) SCREENING ANALYSIS CHROMATOGRAM

Sample Name: H22030372-001A ;0321GC4 , $HC-EPH-SCRN-S,
Raw File: G:\Org\4GC\DAT\4GC032122_b\0321GC4.0017.RAW
Date & Time Acquired: 3/22/2022 1:00:22 AM
Method File: G:\Org\4GC\Methods\SR011022C1.MET
Calibration File: G:\Org\4GC\Cals\SR011022C1.CAL
Sample Weight: 12.7 Dilution: 2 S.A.: 1

Mean RF for C9 to C18 Hydrocarbons: 757.0734
Mean RF for C19 to C36 Hydrocarbons: 780.0031
Mean RF for Total Extractable Hydrocarbons: 768.5382
Rt range for Diesel Range Organics: 7.1 to 17.54
Rt range for C9 to C18 Hydrocarbons: 6.11 to 13.07
Rt range for C19 to C36 Hydrocarbons: 13.12 to 21.08

SURROGATE COMPOUND	RT	AREA	ACTUAL	MEASURED	%REC	
*o-Terphenyl	13.167	102070	15.748	16.83	106.87	-
*1-Chloro-octadecane	13.936	89399	15.748	17.842	113.3	-

DRO Area:9621.719 DRO Amount: 1.971576
TEH Area:43448.46 TEH Amount: 8.902976
C9-C18 Area:22508.02 C9-C18 Amount: 4.681937
C19-C36 Area:7157.609 C19-C36 Amount: 1.4451

BH-2 Batch ID: 60514

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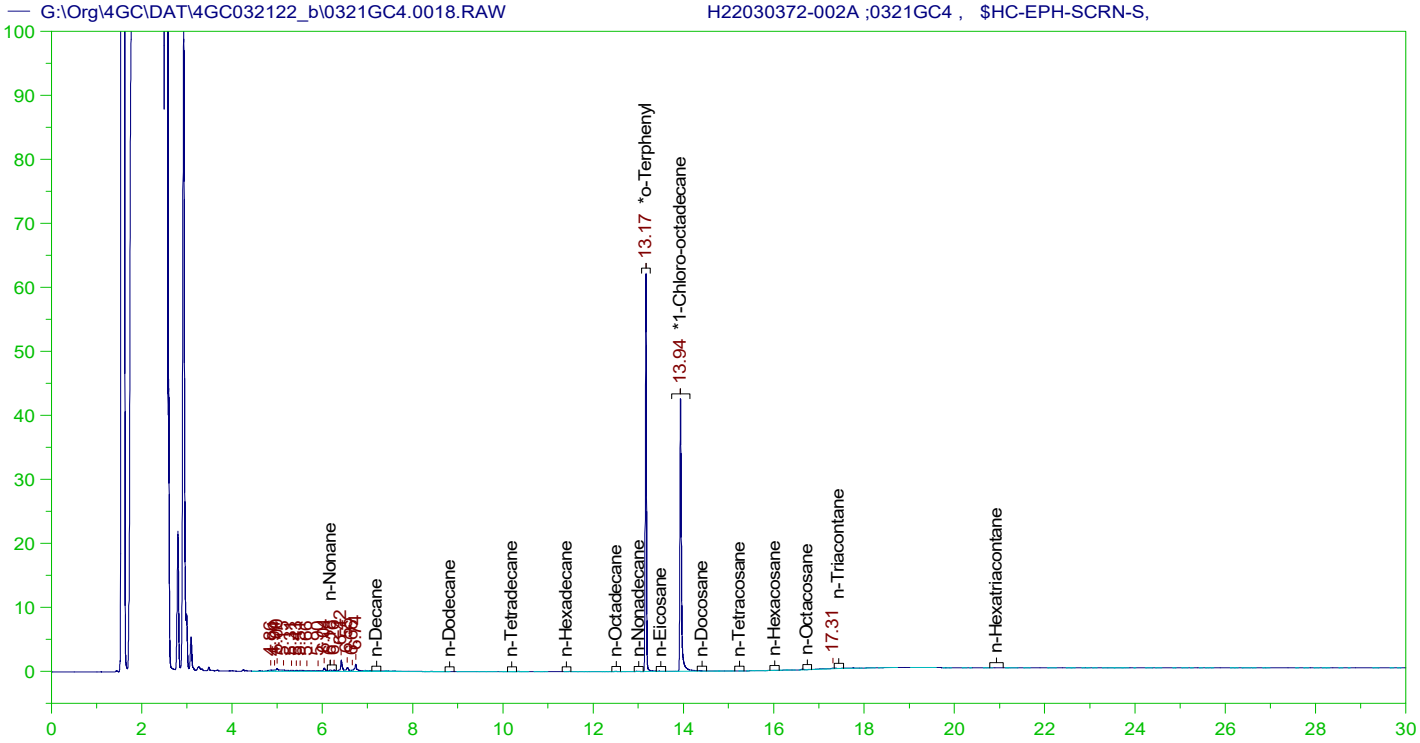

EXTRACTABLE PETROLEUM HYDROCARBONS (EPH) SCREENING ANALYSIS CHROMATOGRAM

Sample Name: H22030372-002A ;0321GC4 , $HC-EPH-SCRN-S,
Raw File: G:\Org\4GC\DAT\4GC032122_b\0321GC4.0018.RAW
Date & Time Acquired: 3/22/2022 1:47:29 AM
Method File: G:\Org\4GC\Methods\SR011022C1.MET
Calibration File: G:\Org\4GC\Cals\SR011022C1.CAL
Sample Weight: 20.8 Dilution: 2 S.A.: 1

Mean RF for C9 to C18 Hydrocarbons: 757.0734
Mean RF for C19 to C36 Hydrocarbons: 780.0031
Mean RF for Total Extractable Hydrocarbons: 768.5382
Rt range for Diesel Range Organics: 7.1 to 17.54
Rt range for C9 to C18 Hydrocarbons: 6.11 to 13.07
Rt range for C19 to C36 Hydrocarbons: 13.12 to 21.08

SURROGATE COMPOUND	RT	AREA	ACTUAL	MEASURED	%REC	
*o-Terphenyl	13.166	105094	9.615	10.581	110.04	-
*1-Chloro-octadecane	13.936	92754	9.615	11.303	117.55	-

DRO Area:4798.141 DRO Amount: 0.6003081
TEH Area:35965.72 TEH Amount: 4.499766
C9-C18 Area:19384.03 C9-C18 Amount: 2.461913
C19-C36 Area:3999.141 C19-C36 Amount: 0.4929888

BH-3 Batch ID: 60514

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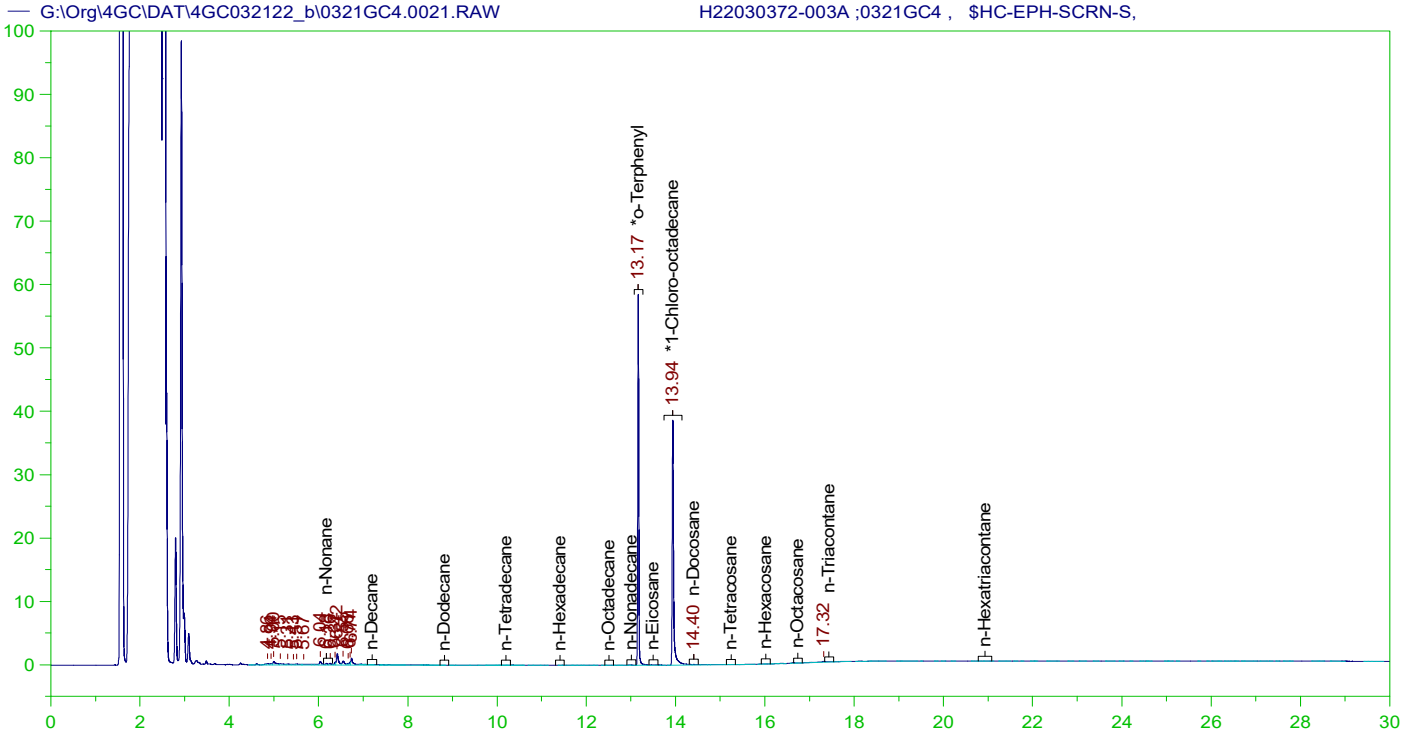

EXTRACTABLE PETROLEUM HYDROCARBONS (EPH) SCREENING ANALYSIS CHROMATOGRAM

Sample Name: H22030372-003A ;0321GC4 , $HC-EPH-SCRN-S,
Raw File: G:\Org\4GC\DAT\4GC032122_b\0321GC4.0021.RAW
Date & Time Acquired: 3/22/2022 4:09:09 AM
Method File: G:\Org\4GC\Methods\SR011022C1.MET
Calibration File: G:\Org\4GC\Cals\SR011022C1.CAL
Sample Weight: 21.1 Dilution: 2 S.A.: 1

Mean RF for C9 to C18 Hydrocarbons: 757.0734
Mean RF for C19 to C36 Hydrocarbons: 780.0031
Mean RF for Total Extractable Hydrocarbons: 768.5382
Rt range for Diesel Range Organics: 7.1 to 17.54
Rt range for C9 to C18 Hydrocarbons: 6.11 to 13.07
Rt range for C19 to C36 Hydrocarbons: 13.12 to 21.08

SURROGATE COMPOUND	RT	AREA	ACTUAL	MEASURED	%REC	
*o-Terphenyl	13.165	98502	9.479	9.776	103.14	-
*1-Chloro-octadecane	13.935	86396	9.479	10.378	109.49	-

DRO Area:5829.031 DRO Amount: 0.7189165
TEH Area:37970.34 TEH Amount: 4.683026
C9-C18 Area:20119.04 C9-C18 Amount: 2.518934
C19-C36 Area:4996.922 C19-C36 Amount: 0.6072307

BH-4 Batch ID: 60514

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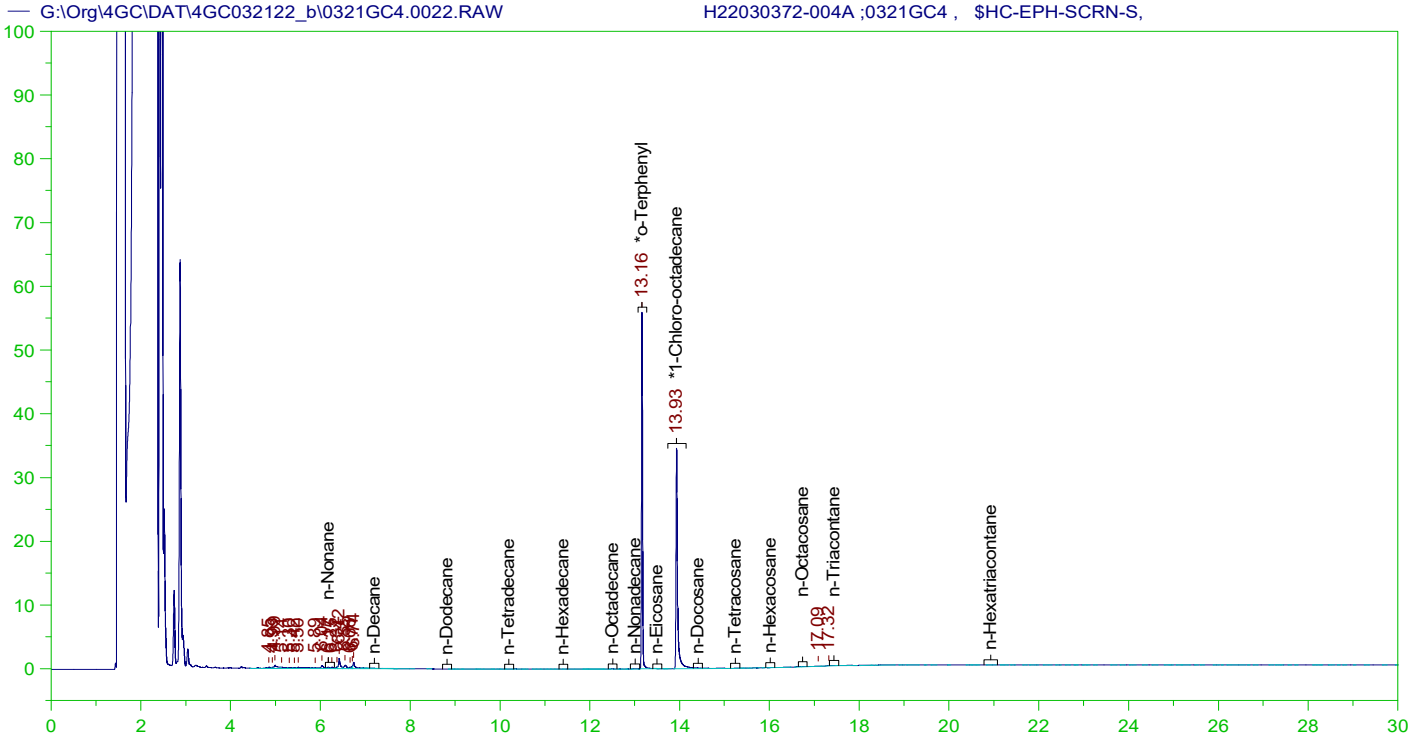

EXTRACTABLE PETROLEUM HYDROCARBONS (EPH) SCREENING ANALYSIS CHROMATOGRAM

Sample Name: H22030372-004A ;0321GC4 , $HC-EPH-SCRN-S,
Raw File: G:\Org\4GC\DAT\4GC032122_b\0321GC4.0022.RAW
Date & Time Acquired: 3/22/2022 4:56:12 AM
Method File: G:\Org\4GC\Methods\SR011022C1.MET
Calibration File: G:\Org\4GC\Cals\SR011022C1.CAL
Sample Weight: 22.3 Dilution: 2 S.A.: 1

Mean RF for C9 to C18 Hydrocarbons: 757.0734
Mean RF for C19 to C36 Hydrocarbons: 780.0031
Mean RF for Total Extractable Hydrocarbons: 768.5382
Rt range for Diesel Range Organics: 7.1 to 17.54
Rt range for C9 to C18 Hydrocarbons: 6.11 to 13.07
Rt range for C19 to C36 Hydrocarbons: 13.12 to 21.08

SURROGATE COMPOUND	RT	AREA	ACTUAL	MEASURED	%REC	
*o-Terphenyl	13.164	97109	8.969	9.119	101.68	-
*1-Chloro-octadecane	13.935	84533	8.969	9.608	107.13	-

DRO Area:3968.523 DRO Amount: 0.4631148
TEH Area:35898.77 TEH Amount: 4.189279
C9-C18 Area:18336.45 C9-C18 Amount: 2.172213
C19-C36 Area:3388.977 C19-C36 Amount: 0.3896704

Field Duplicate Batch ID: 60547

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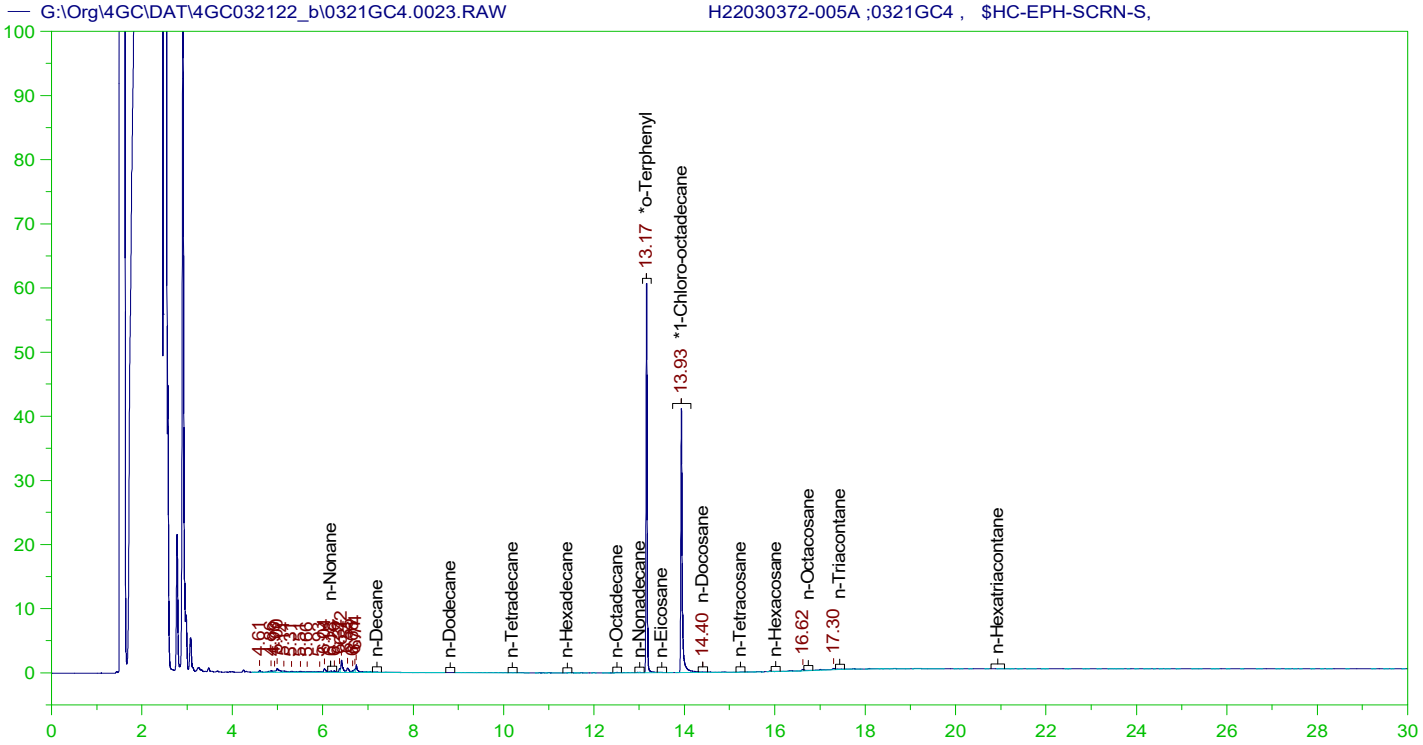


EXTRACTABLE PETROLEUM HYDROCARBONS (EPH) SCREENING ANALYSIS CHROMATOGRAM

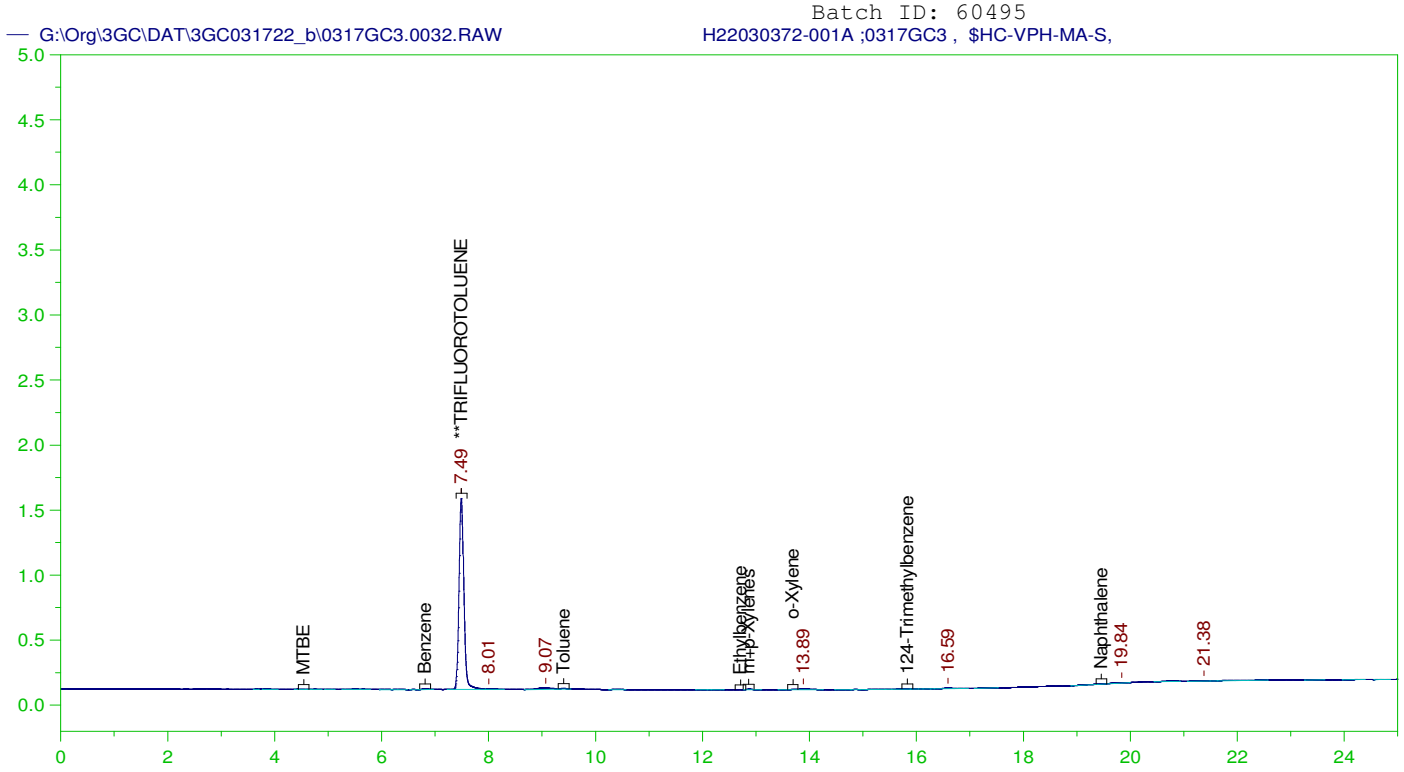
Sample Name: H22030372-005A ;0321GC4 , $HC-EPH-SCRN-S,
Raw File: G:\Org\4GC\DAT\4GC032122_b\0321GC4.0023.RAW
Date & Time Acquired: 3/22/2022 5:43:17 AM
Method File: G:\Org\4GC\Methods\SR011022C1.MET
Calibration File: G:\Org\4GC\Cals\SR011022C1.CAL
Sample Weight: 22.4 Dilution: 2 S.A.: 1

Mean RF for C9 to C18 Hydrocarbons: 757.0734
Mean RF for C19 to C36 Hydrocarbons: 780.0031
Mean RF for Total Extractable Hydrocarbons: 768.5382
Rt range for Diesel Range Organics: 7.1 to 17.54
Rt range for C9 to C18 Hydrocarbons: 6.11 to 13.07
Rt range for C19 to C36 Hydrocarbons: 13.12 to 21.08

SURROGATE COMPOUND	RT	AREA	ACTUAL	MEASURED	%REC	
*o-Terphenyl	13.165	101929	8.929	9.529	106.72	-
*1-Chloro-octadecane	13.935	89521	8.929	10.13	113.45	-

DRO Area:8195.523 DRO Amount: 0.9521233
TEH Area:41984.1 TEH Amount: 4.877546
C9-C18 Area:20434.1 C9-C18 Amount: 2.409903
C19-C36 Area:7806.414 C19-C36 Amount: 0.8935878

Batch ID: 60495



VPH AROMATICS PHOTOIONIZATION DETECTOR CHROMATOGRAM REPORT

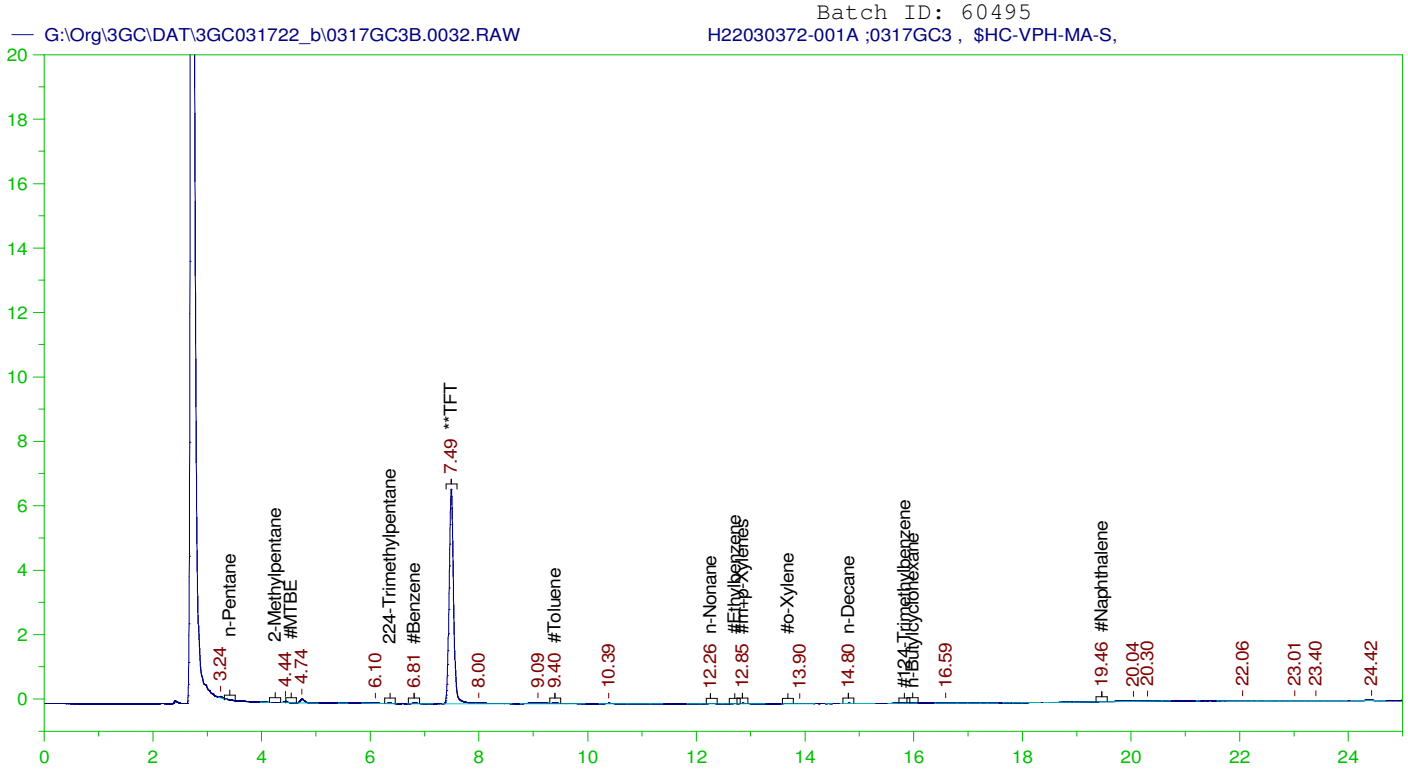
Sample Name: H22030372-001A ;0317GC3 , $HC-VPH-MA-S,
Raw File: G:\Org\3GC\DAT\3GC031722_b\0317GC3.0032.RAW
Date & Time Acquired: 3/18/2022 4:24:20 AM
Method File: G:\Org\3gc\Methods\GC3031122.MET
Calibration File: G:\Org\3gc\Cals\GC3031122.CAL
Sample Weight: 50 Dilution: 1.46 S.A.: 1.46

Mean RF for C9 to C10 Aromatic Hydrocarbons: 209.904
Rt range for C9 to C10 Aromatics: 13.789 to 19.361
Aromatic Hydrocarbon Range Area and Quantitation:
C9-C10 Aromatics Area:286.1479 C9-C10 Aromatics Amount: 3.980638E-02

TARGET ANALYTES	RT	CAL RRT	RRT	AREA	AMOUNT	FLAG
MTBE	.	.	.		.146	U
Benzene	.	.	.		.073	U
Toluene	.	.	.		.073	U
Ethylbenzene	.	.	.		.073	U
m+p-Xylenes	.	.	.		.073	U
o-Xylene	.	.	.		.073	U
124-Trimethylbenzene	.	.	.		.073	U
Naphthalene	.	.	.		.146	U

SURROGATE COMPOUND	RT	ACTUAL	MEASURED	%REC	QC LIMITS
**TRIFLUOROTOLUENE	7.49	3.65	3.128	85.71	70-130

Batch ID: 60495



VPH ALIPHATICS FLAME IONIZATION DETECTOR CHROMATOGRAM REPORT

Sample Name: H22030372-001A ;0317GC3 , $HC-VPH-MA-S,
Raw File: G:\Org\3GC\DAT\3GC031722_b\0317GC3B.0032.RAW
Date & Time Acquired: 3/18/2022 4:24:20 AM
Method File: G:\Org\3gc\Methods\GC3031122B.MET
Calibration File: G:\Org\3gc\Cals\GC3031122B.CAL
Sample Weight: 50 Dilution: 1.46 S.A.: 1.46

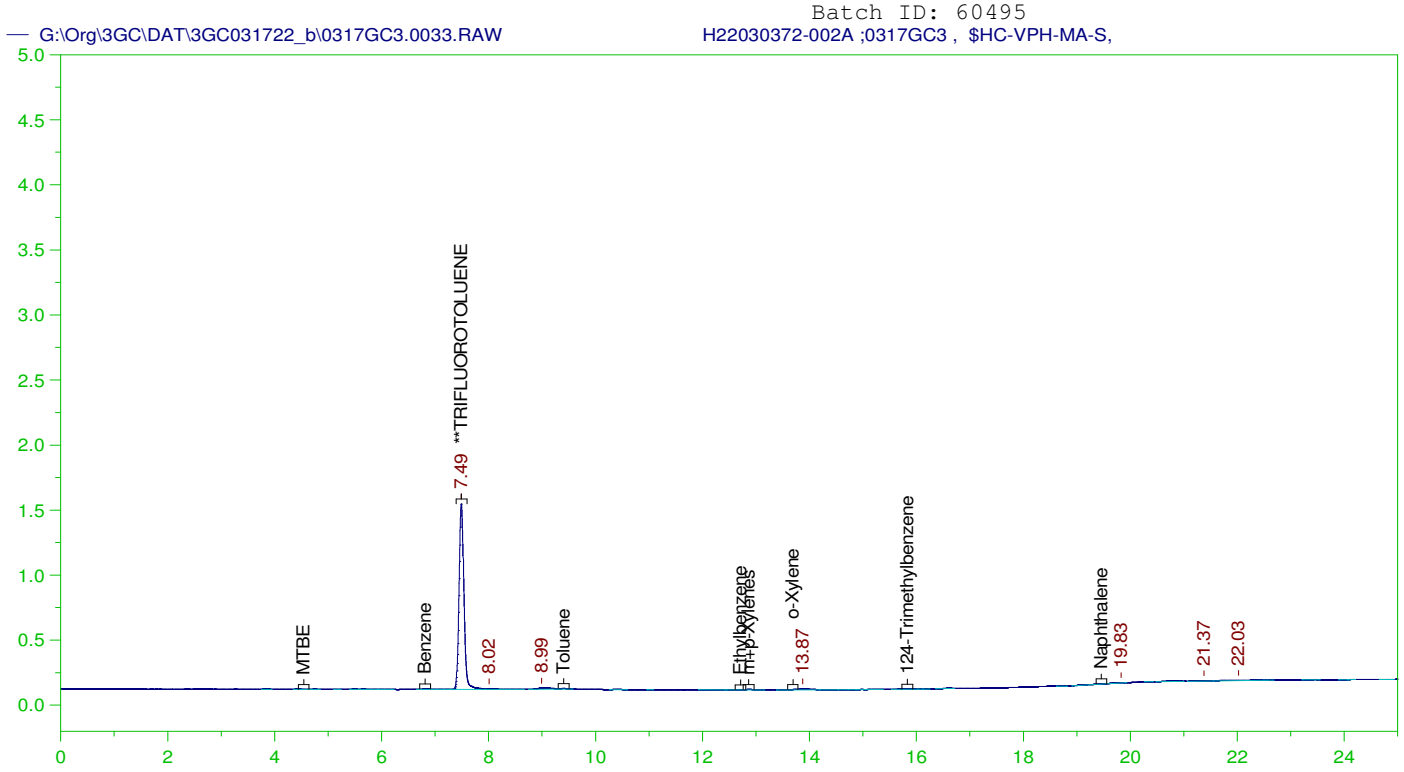
Mean RF for C5 to C8 Aliphatic Hydrocarbons: 470.9312
Mean RF for C9 to C12 Aliphatic Hydrocarbons: 341.9892
Mean RF for all calibrated compounds: 463.4642
Rt range for Gasoline Range Organics: 4.151 to 14.901
Rt range for C5 to C8 Aliphatic Hydrocarbons: 3.32 to 12.184
Rt range for C9 to C12 Aliphatic Hydrocarbons: 12.234 to 19.358

SURROGATE COMPOUND	RT	ACTUAL	MEASURED	%REC	
**TFT	7.49	3.65	3.32	90.96	-

GRO Area:3001.625 GRO Amount: 0.1891138
TPH Area:4718.789 TPH Amount: 0.2973016

Aliphatic Hydrocarbon Areas and Quantitations uncorrected for Aromatics:
C5-C8 Area:2472.336 C5-C8 Amount: 0.1532967
C9-C12 Area:1014.408 C9-C12 Amount: 8.661298E-02

Batch ID: 60495



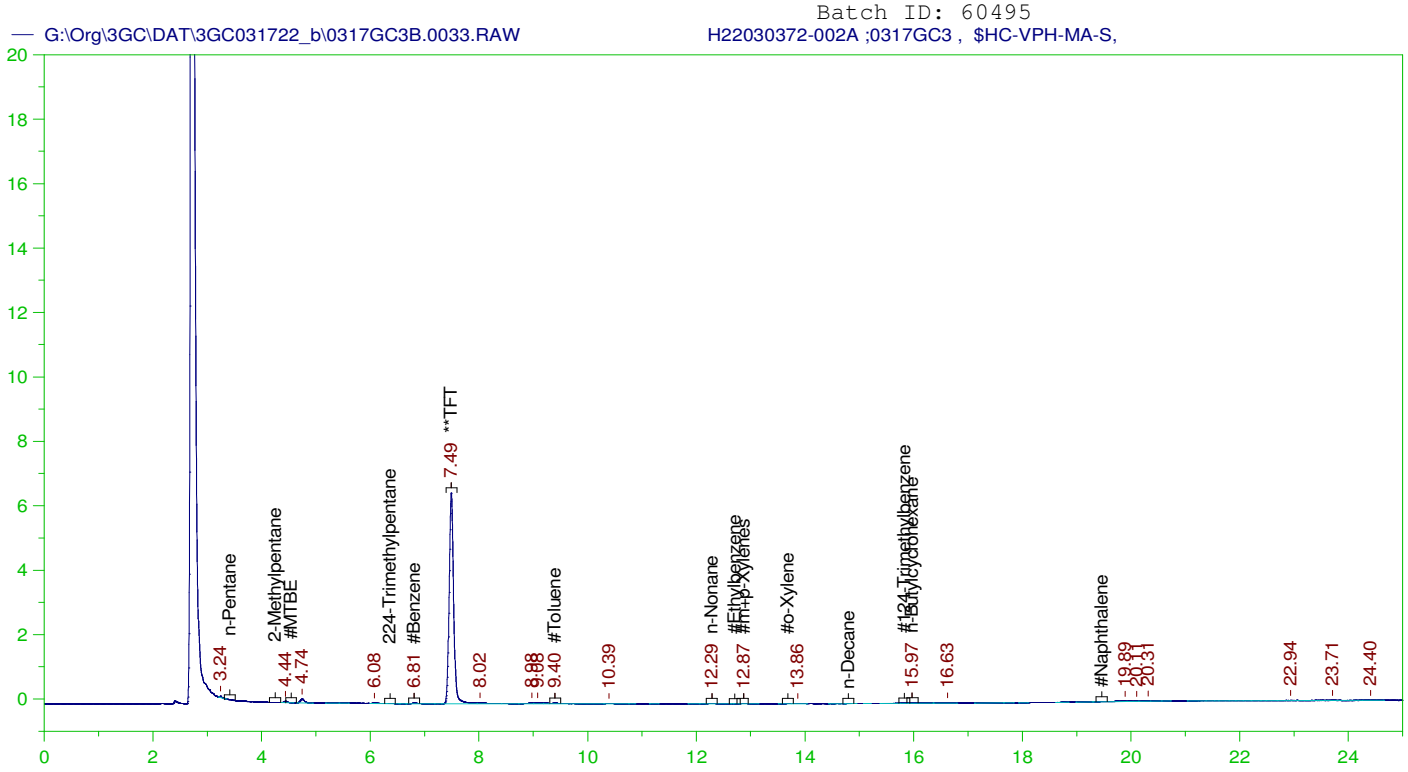
VPH AROMATICS PHOTOIONIZATION DETECTOR CHROMATOGRAM REPORT
Sample Name: H22030372-002A ;0317GC3 , $HC-VPH-MA-S,
Raw File: G:\Org\3GC\DAT\3GC031722_b\0317GC3.0033.RAW
Date & Time Acquired: 3/18/2022 4:57:10 AM
Method File: G:\Org\3gc\Methods\GC3031122.MET
Calibration File: G:\Org\3gc\Cals\GC3031122.CAL
Sample Weight: 50 Dilution: 1.44 S.A.: 1.44

Mean RF for C9 to C10 Aromatic Hydrocarbons: 209.904
Rt range for C9 to C10 Aromatics: 13.789 to 19.361
Aromatic Hydrocarbon Range Area and Quantitation:
C9-C10 Aromatics Area:234.8569 C9-C10 Aromatics Amount: 3.222368E-02

TARGET ANALYTES	RT	CAL RRT	RRT	AREA	AMOUNT	FLAG
MTBE	.	.	.		.144	U
Benzene	.	.	.		.072	U
Toluene	.	.	.		.072	U
Ethylbenzene	.	.	.		.072	U
m+p-Xylenes	.	.	.		.072	U
o-Xylene	.	.	.		.072	U
124-Trimethylbenzene	.	.	.		.072	U
Naphthalene	.	.	.		.144	U

SURROGATE COMPOUND	RT	ACTUAL	MEASURED	%REC	QC LIMITS
**TRIFLUOROTOLUENE	7.49	3.6	3.005	83.48	70-130

Batch ID: 60495



VPH ALIPHATICS FLAME IONIZATION DETECTOR CHROMATOGRAM REPORT

Sample Name: H22030372-002A ;0317GC3 , $HC-VPH-MA-S,
Raw File: G:\Org\3GC\DAT\3GC031722_b\0317GC3B.0033.RAW
Date & Time Acquired: 3/18/2022 4:57:10 AM
Method File: G:\Org\3gc\Methods\GC3031122B.MET
Calibration File: G:\Org\3gc\Cals\GC3031122B.CAL
Sample Weight: 50 Dilution: 1.44 S.A.: 1.44

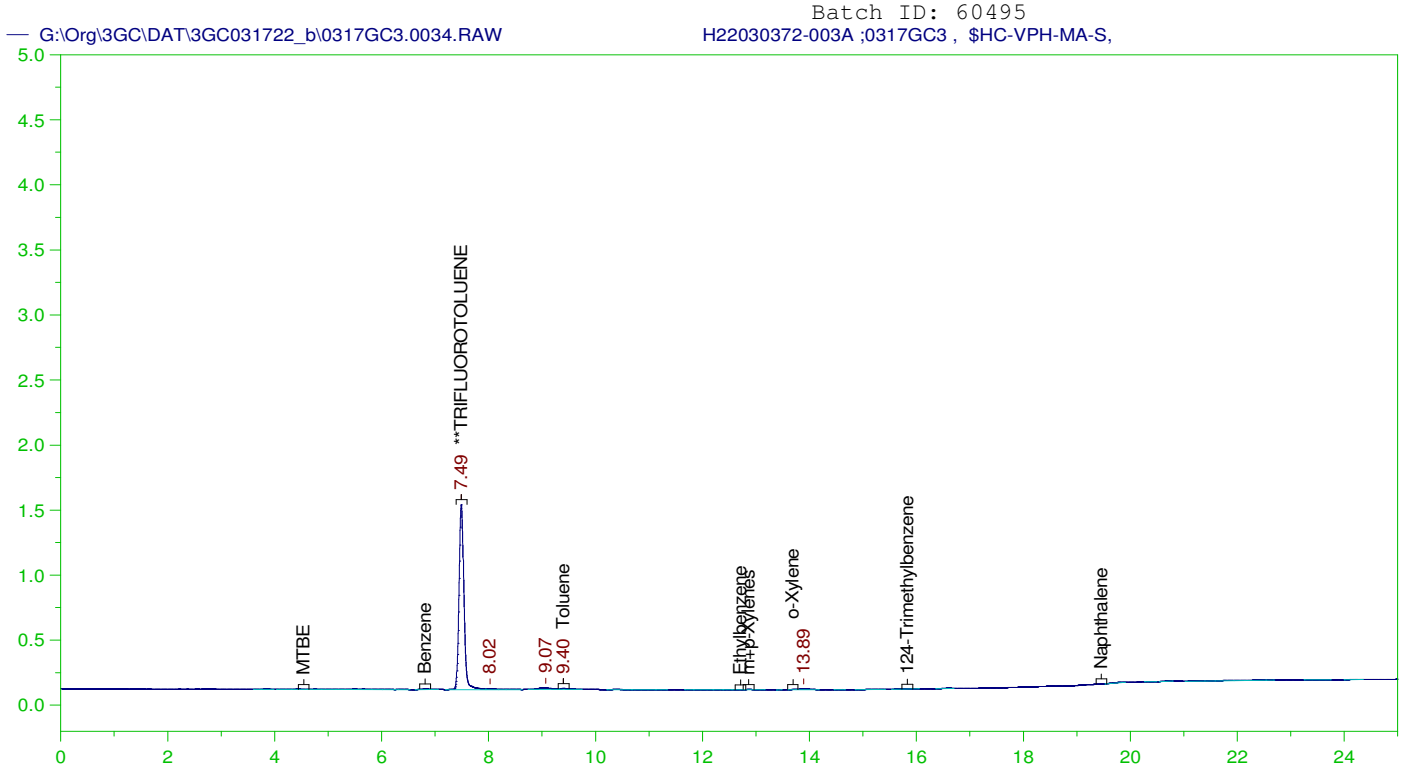
Mean RF for C5 to C8 Aliphatic Hydrocarbons: 470.9312
Mean RF for C9 to C12 Aliphatic Hydrocarbons: 341.9892
Mean RF for all calibrated compounds: 463.4642
Rt range for Gasoline Range Organics: 4.151 to 14.901
Rt range for C5 to C8 Aliphatic Hydrocarbons: 3.32 to 12.184
Rt range for C9 to C12 Aliphatic Hydrocarbons: 12.234 to 19.358

SURROGATE COMPOUND	RT	ACTUAL	MEASURED	%REC	
**TFT	7.49	3.6	3.232	89.78	-

GRO Area:3003.465 GRO Amount: 0.1866375
TPH Area:4972.688 TPH Amount: 0.3090064

Aliphatic Hydrocarbon Areas and Quantitations uncorrected for Aromatics:
C5-C8 Area:2549.172 C5-C8 Amount: 0.1558957
C9-C12 Area:1002.627 C9-C12 Amount: 0.0844344

Batch ID: 60495



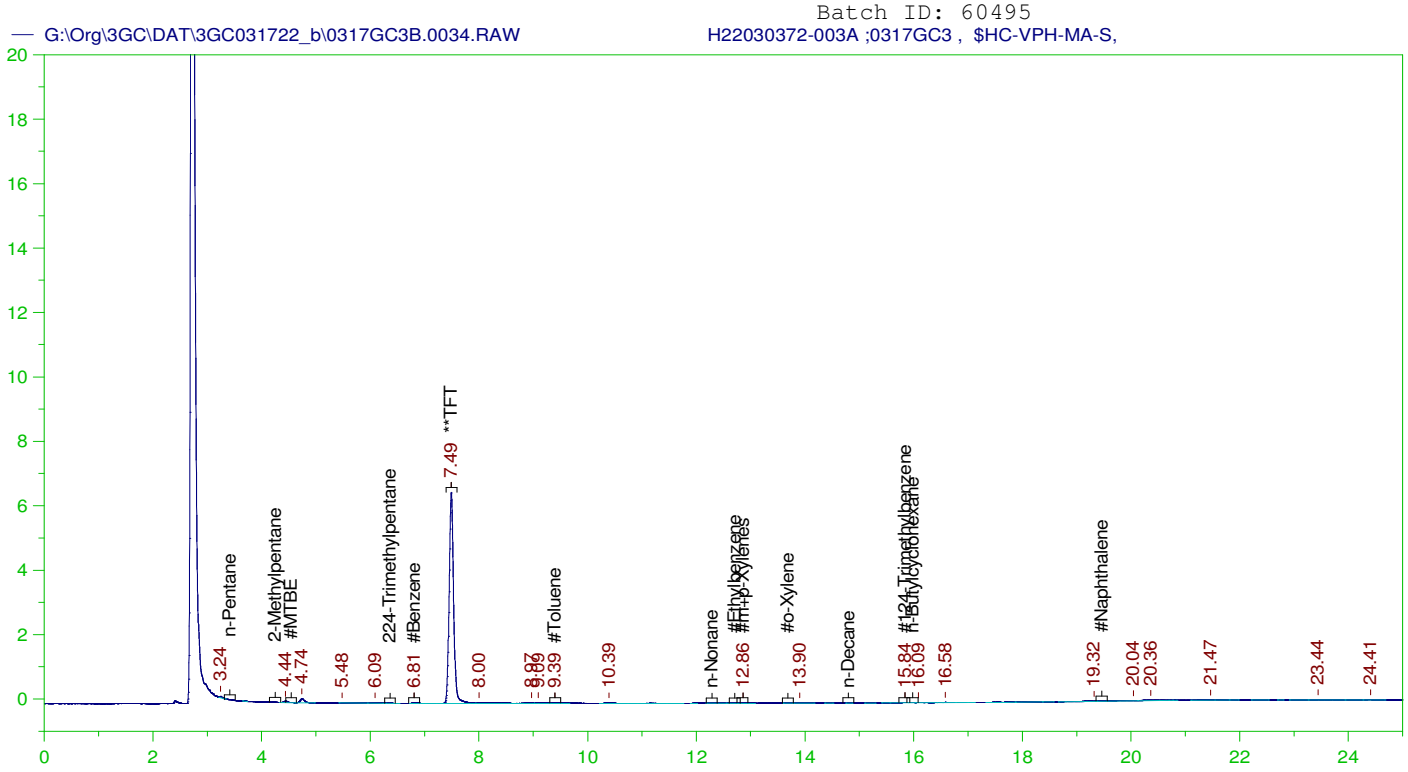
VPH AROMATICS PHOTOIONIZATION DETECTOR CHROMATOGRAM REPORT
Sample Name: H22030372-003A ;0317GC3 , $HC-VPH-MA-S,
Raw File: G:\Org\3GC\DAT\3GC031722_b\0317GC3.0034.RAW
Date & Time Acquired: 3/18/2022 5:30:13 AM
Method File: G:\Org\3gc\Methods\GC3031122.MET
Calibration File: G:\Org\3gc\Cals\GC3031122.CAL
Sample Weight: 50 Dilution: 1.37 S.A.: 1.37

Mean RF for C9 to C10 Aromatic Hydrocarbons: 209.904
Rt range for C9 to C10 Aromatics: 13.789 to 19.361
Aromatic Hydrocarbon Range Area and Quantitation:
C9-C10 Aromatics Area:158.6414 C9-C10 Aromatics Amount: 2.070839E-02

TARGET ANALYTES	RT	CAL RRT	RRT	AREA	AMOUNT	FLAG
MTBE	.	.	.		.137	U
Benzene	.	.	.		.069	U
Toluene	9.398	9.398	9.398	73	.069	U
Ethylbenzene	.	.	.		.069	U
m+p-Xylenes	.	.	.		.069	U
o-Xylene	.	.	.		.069	U
124-Trimethylbenzene	.	.	.		.069	U
Naphthalene	.	.	.		.137	U

SURROGATE COMPOUND	RT	ACTUAL	MEASURED	%REC	QC LIMITS
**TRIFLUOROTOLUENE	7.49	3.425	2.851	83.25	70-130

Batch ID: 60495



VPH ALIPHATICS FLAME IONIZATION DETECTOR CHROMATOGRAM REPORT

Sample Name: H22030372-003A ;0317GC3 , $HC-VPH-MA-S,
Raw File: G:\Org\3GC\DAT\3GC031722_b\0317GC3B.0034.RAW
Date & Time Acquired: 3/18/2022 5:30:13 AM
Method File: G:\Org\3gc\Methods\GC3031122B.MET
Calibration File: G:\Org\3gc\Cals\GC3031122B.CAL
Sample Weight: 50 Dilution: 1.37 S.A.: 1.37

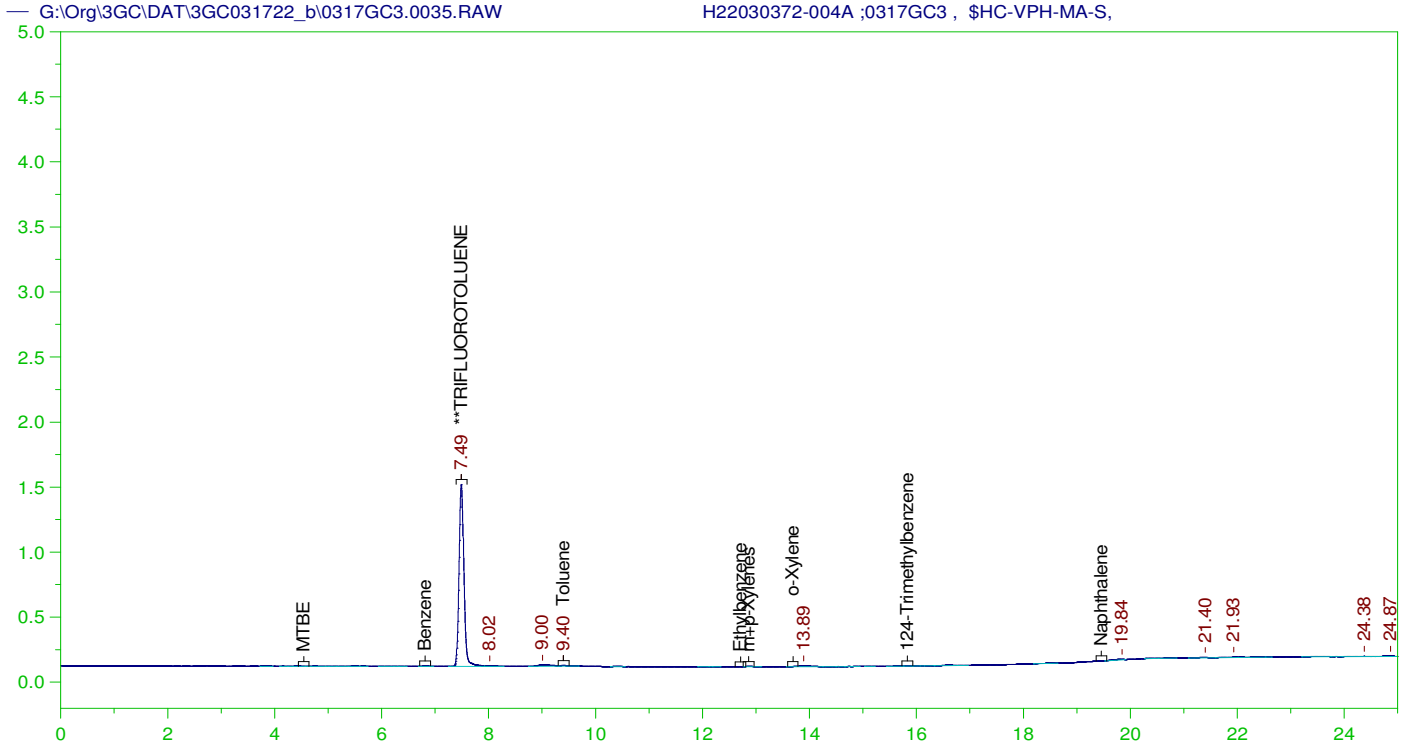
Mean RF for C5 to C8 Aliphatic Hydrocarbons: 470.9312
Mean RF for C9 to C12 Aliphatic Hydrocarbons: 341.9892
Mean RF for all calibrated compounds: 463.4642
Rt range for Gasoline Range Organics: 4.151 to 14.901
Rt range for C5 to C8 Aliphatic Hydrocarbons: 3.32 to 12.184
Rt range for C9 to C12 Aliphatic Hydrocarbons: 12.234 to 19.358

SURROGATE COMPOUND	RT	ACTUAL	MEASURED	%REC	
**TFT	7.49	3.425	3.063	89.43	-

GRO Area:2863.43 GRO Amount: 0.169286
TPH Area:4891.902 TPH Amount: 0.2892092

Aliphatic Hydrocarbon Areas and Quantitations uncorrected for Aromatics:
C5-C8 Area:2517.648 C5-C8 Amount: 0.1464833
C9-C12 Area:1095.005 C9-C12 Amount: 8.773126E-02

Batch ID: 60495



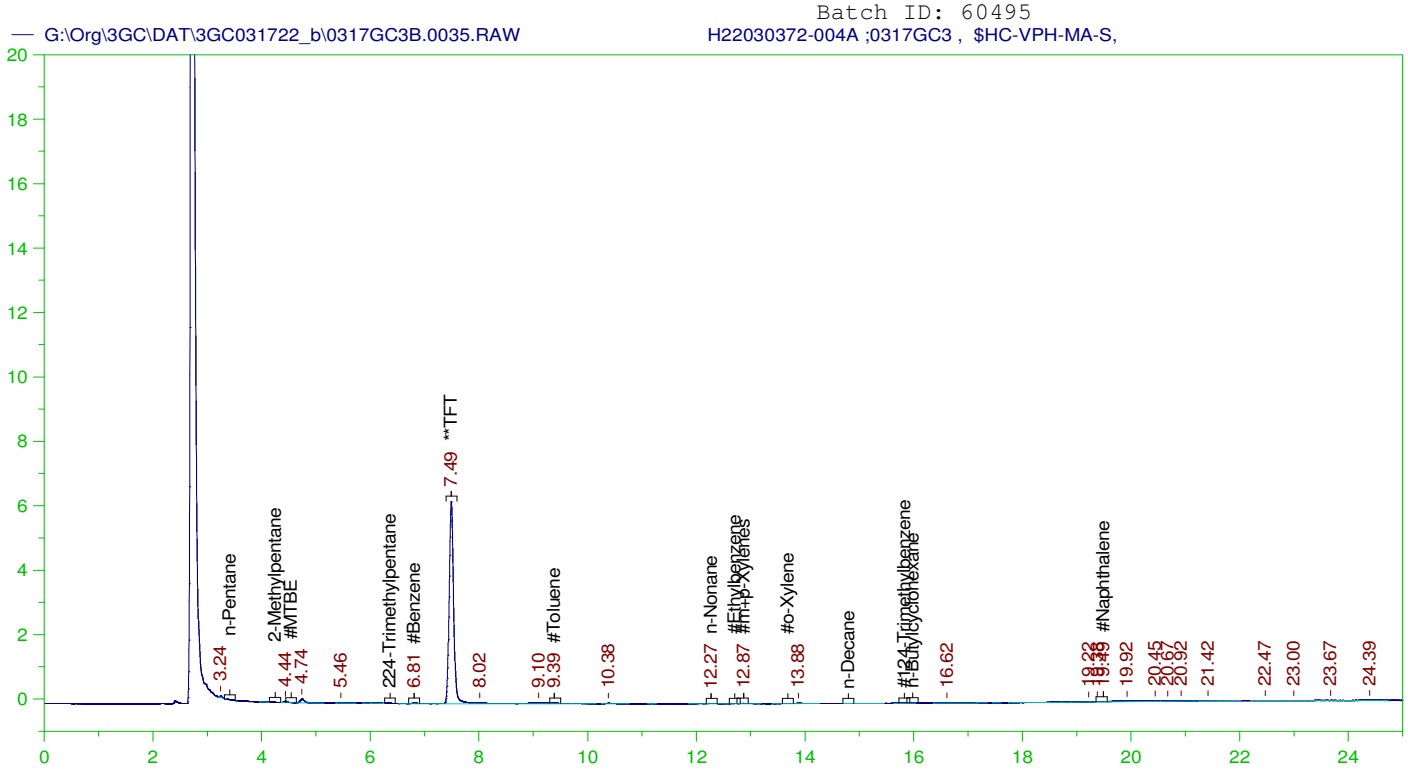
VPH AROMATICS PHOTOIONIZATION DETECTOR CHROMATOGRAM REPORT
Sample Name: H22030372-004A ;0317GC3 , $HC-VPH-MA-S,
Raw File: G:\Org\3GC\DAT\3GC031722_b\0317GC3.0035.RAW
Date & Time Acquired: 3/18/2022 6:02:58 AM
Method File: G:\Org\3gc\Methods\GC3031122.MET
Calibration File: G:\Org\3gc\Cals\GC3031122.CAL
Sample Weight: 50 Dilution: 1.38 S.A.: 1.38

Mean RF for C9 to C10 Aromatic Hydrocarbons: 209.904
Rt range for C9 to C10 Aromatics: 13.789 to 19.361
Aromatic Hydrocarbon Range Area and Quantitation:
C9-C10 Aromatics Area:260.3586 C9-C10 Aromatics Amount: 3.423421E-02

TARGET ANALYTES	RT	CAL RRT	RRT	AREA	AMOUNT	FLAG
MTBE	.	.	.		.138	U
Benzene	.	.	.		.069	U
Toluene	9.395	9.395	9.395	61	.069	U
Ethylbenzene	.	.	.		.069	U
m+p-Xylenes	.	.	.		.069	U
o-Xylene	.	.	.		.069	U
124-Trimethylbenzene	.	.	.		.069	U
Naphthalene	.	.	.		.138	U

SURROGATE COMPOUND	RT	ACTUAL	MEASURED	%REC	QC LIMITS
**TRIFLUOROTOLUENE	7.49	3.45	2.818	81.68	70-130

Batch ID: 60495



VPH ALIPHATICS FLAME IONIZATION DETECTOR CHROMATOGRAM REPORT

Sample Name: H22030372-004A ;0317GC3 , $HC-VPH-MA-S,
Raw File: G:\Org\3GC\DAT\3GC031722_b\0317GC3B.0035.RAW
Date & Time Acquired: 3/18/2022 6:02:58 AM
Method File: G:\Org\3gc\Methods\GC3031122B.MET
Calibration File: G:\Org\3gc\Cals\GC3031122B.CAL
Sample Weight: 50 Dilution: 1.38 S.A.: 1.38

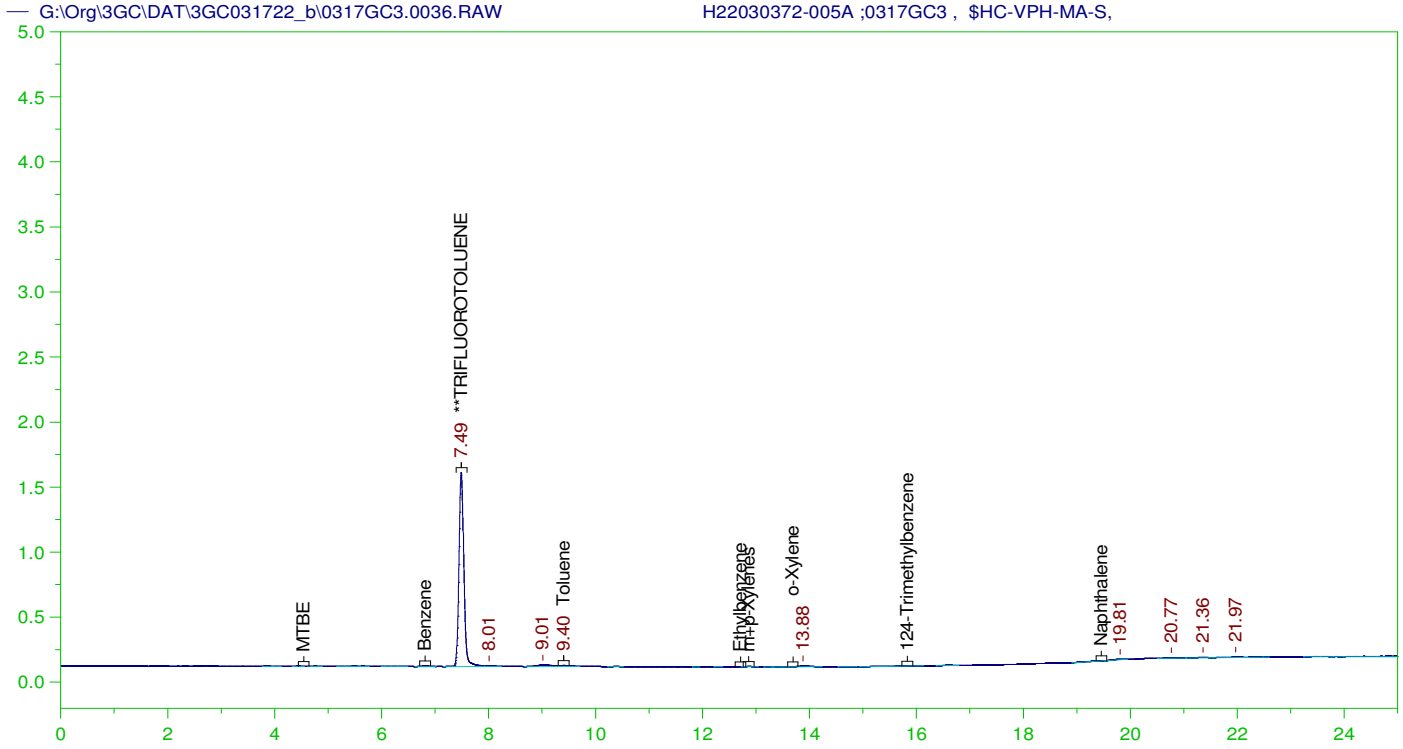
Mean RF for C5 to C8 Aliphatic Hydrocarbons: 470.9312
Mean RF for C9 to C12 Aliphatic Hydrocarbons: 341.9892
Mean RF for all calibrated compounds: 463.4642
Rt range for Gasoline Range Organics: 4.151 to 14.901
Rt range for C5 to C8 Aliphatic Hydrocarbons: 3.32 to 12.184
Rt range for C9 to C12 Aliphatic Hydrocarbons: 12.234 to 19.358

SURROGATE COMPOUND	RT	ACTUAL	MEASURED	%REC	
**TFT	7.49	3.45	2.965	85.94	-

GRO Area:3138.488 GRO Amount: 0.1869018
TPH Area:6348.293 TPH Amount: 0.3780505

Aliphatic Hydrocarbon Areas and Quantitations uncorrected for Aromatics:
C5-C8 Area:2702.664 C5-C8 Amount: 0.1583958
C9-C12 Area:1100.091 C9-C12 Amount: 8.878204E-02

Batch ID: 60495



VPH AROMATICS PHOTOIONIZATION DETECTOR CHROMATOGRAM REPORT

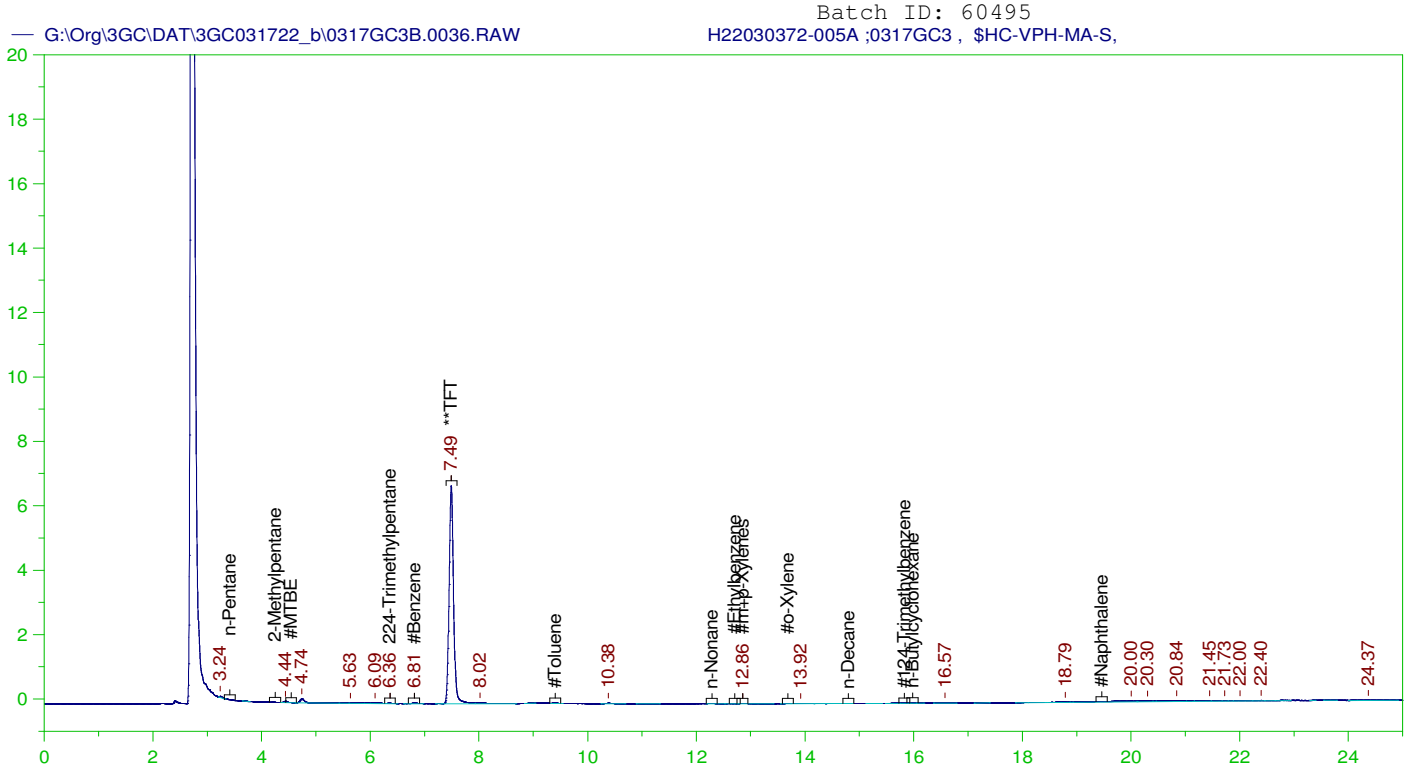
Sample Name: H22030372-005A ;0317GC3 , $HC-VPH-MA-S,
Raw File: G:\Org\3GC\DAT\3GC031722_b\0317GC3.0036.RAW
Date & Time Acquired: 3/18/2022 6:35:41 AM
Method File: G:\Org\3gc\Methods\GC3031122.MET
Calibration File: G:\Org\3gc\Cals\GC3031122.CAL
Sample Weight: 50 Dilution: 1.36 S.A.: 1.36

Mean RF for C9 to C10 Aromatic Hydrocarbons: 209.904
Rt range for C9 to C10 Aromatics: 13.789 to 19.361
Aromatic Hydrocarbon Range Area and Quantitation:
C9-C10 Aromatics Area:207.4378 C9-C10 Aromatics Amount: 2.688042E-02

TARGET ANALYTES	RT	CAL RRT	RRT	AREA	AMOUNT	FLAG
MTBE	.	.	.		.136	U
Benzene	.	.	.		.068	U
Toluene	9.403	9.403	9.403	66	.068	U
Ethylbenzene	.	.	.		.068	U
m+p-Xylenes	.	.	.		.068	U
o-Xylene	.	.	.		.068	U
124-Trimethylbenzene	.	.	.		.068	U
Naphthalene	.	.	.		.136	U

SURROGATE COMPOUND	RT	ACTUAL	MEASURED	%REC	QC LIMITS
**TRIFLUOROTOLUENE	7.489	3.4	2.951	86.81	70-130

Batch ID: 60495



VPH ALIPHATICS FLAME IONIZATION DETECTOR CHROMATOGRAM REPORT

Sample Name: H22030372-005A ;0317GC3 , $HC-VPH-MA-S,
Raw File: G:\Org\3GC\DAT\3GC031722_b\0317GC3B.0036.RAW
Date & Time Acquired: 3/18/2022 6:35:41 AM
Method File: G:\Org\3gc\Methods\GC3031122B.MET
Calibration File: G:\Org\3gc\Cals\GC3031122B.CAL
Sample Weight: 50 Dilution: 1.36 S.A.: 1.36

Mean RF for C5 to C8 Aliphatic Hydrocarbons: 470.9312
Mean RF for C9 to C12 Aliphatic Hydrocarbons: 341.9892
Mean RF for all calibrated compounds: 463.4642
Rt range for Gasoline Range Organics: 4.151 to 14.901
Rt range for C5 to C8 Aliphatic Hydrocarbons: 3.32 to 12.184
Rt range for C9 to C12 Aliphatic Hydrocarbons: 12.234 to 19.358

SURROGATE COMPOUND	RT	ACTUAL	MEASURED	%REC	
**TFT	7.489	3.4	3.139	92.33	-

GRO Area:2561.586 GRO Amount: 0.1503355
TPH Area:6553.863 TPH Amount: 0.3846361

Aliphatic Hydrocarbon Areas and Quantitations uncorrected for Aromatics:
C5-C8 Area:2112.953 C5-C8 Amount: 0.1220397
C9-C12 Area:1059.296 C9-C12 Amount: 8.425079E-02

Work Order Receipt Checklist

TD and H Engineering

H22030372

Login completed by: Wanda Johnson
Date Received: 3/15/2022

Reviewed by: BL2000\acarlson
Received by: RMF

Reviewed Date: 3/31/2022
Carrier name: FedEx Express

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☐	No ☑	Not Applicable ☐
Container/Temp Blank temperature:	4.6°C On Ice		
Containers requiring zero headspace have no headspace or bubble that is <6mm (1/4").	Yes ☑	No ☐	No VOA vials submitted ☐
Water - pH acceptable upon receipt?	Yes ☑	No ☐	Not Applicable ☐

Standard Reporting Procedures:

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

The reference date for Radon analysis is the sample collection date. The reference date for all other Radiochemical analyses is the analysis date. Radiochemical precision results represent a 2-sigma Total Measurement Uncertainty.

Contact and Corrective Action Comments:

None

ENERGY LABORATORIES
Trust our People. Trust our Data.

Chain of Custody & Analytical Request Record

www.energylab.com

Account Information (Billing information)

Company/Name	TD&H Engineering
Contact	Annette Hobbs
Phone	406.761.3010
Mailing Address	1800 River Drive North
City, State, Zip	Great Falls, MT 59401
Email	annette.hobbs@tdhengineering.com
Receive Invoice	☐Hard Copy ☒Email
Receive Report	☐Hard Copy ☒Email
Purchase Order	21-035
Quote	na
Bottle Order	na

Report Information (If different than Account Information)

Company/Name	TD&H Engineering
Contact	Corey League
Phone	406.760.1321
Mailing Address	1800 River Drive North
City, State, Zip	Great Falls, MT 59401
Email	corey.league@tdhengineering.com
Receive Report	☐Hard Copy ☒Email

Special Report/Formats:
☐ LEVEL IV ☐NELAC ☐ EDD/EDT (contact laboratory) ☐ Other_____

Comments

Project Information

Project Name, PWSID, Permit, etc.	21-035
Sampler Name	Corey League
Sampler Phone	406.760.1321
Sample Origin State	MT
EPA/State Compliance	☒ Yes ☐ No

URANIUM MINING CLIENTS MUST Indicate sample type
☐ Unprocessed Ore
☐ Processed Ore (Ground or Refined) **CALL BEFORE SENDING
☐ 11(e)2 Byproduct Material (Can ONLY be Submitted to ELI Casper Location)

Matrix Codes
A - Air
W - Water
S - Soils/Solids
V - Vegetation
B - Bioassay
O - Oil
DW - Drinking Water

All turnaround times are standard unless marked as RUSH.
Energy Laboratories MUST be contacted prior to RUSH sample submittal for charges and scheduling -- See Instructions Page

	Sample Identification (Name, Location, Interval, etc.)	Collection Date	Collection Time	Number of Containers	Matrix (See Codes Above)	VPH	EPH	Total Purgable Hydrocarbons	EDB	DCA					See Attached	RUSH TAT	ELI LAB ID (Laboratory Use Only)
1	BH-1-14.0-15.0	03/11/2022	9:40 am	2	S	✓	✓	✓	✓	✓							L22030372
2	BH-2-14.5-15.0	03/11/2022	11:00 am	2	S	✓	✓	✓	✓	✓							
3	BH-3-9.5-10.0	03/11/2022	12:00 ~~am~~ pm	2	S	✓	✓	✓	✓	✓							
4	BH-4-11.5-12.0	03/11/2022	1:00 pm	1	S	✓	✓	✓	✓	✓							
5	Field Duplicate	03/11/2022	1:00 pm	1	S	✓	✓	✓	✓	✓							
6																	
7																	
8																	
9																	

ELI is REQUIRED to provide preservative traceability. If the preservatives supplied with the bottle order were **NOT** used, please attach your preservative information with this COC.

Custody Record MUST be signed	Relinquished by (print)	Date/Time	Signature	Received by (print)	Date/Time	Signature
	Corey League	03/14/22 1140				
	Relinquished by (print)	Date/Time	Signature	Received by Laboratory (print)	Date/Time	Signature
				Rhoda Hoskedal	3/15/22 1008	

LABORATORY USE ONLY

Shipped By	Cooler ID(s)	Custody Seals	Intact	Receipt Temp	Temp Blank	On Ice	Payment Type	Amount	Receipt Number (cash/check only)
FedEx Express	Y	(N) N ○ B	✓ N	4.6 °C	Y (N)	✓ N	CC Cash Check_____	$	

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All subcontracted data will be clearly notated on your analytical report.

APPENDIX D
DEQ Data Validation Form

Montana DEQ - Waste Management and Remediation Division

Data Validation Summary Form (Version 1.3.0, Revised 1/26/18)

Please fill out the information below, using one form for each lab batch (one form can be used for multiple analytical methods). The form will grow and adjust, based on your responses. Please include a discussion regarding the sampling event in the report that is sent to DEQ with this form. For additional instructions, please click the Open Complete Instructions button.

Open Complete Instructions

Basic Questions View example (Note: example optimized for viewing in Chrome browser)

1. Site/Facility name	206 5th Street South - Great Falls, Montana
2. Site code or facility ID (if applicable)	Grant Number: BF95809510-0
3. Release ID (if applicable)	
4. Sample delivery group	Energy Work Order: H22030372
5. Name of DEQ-approved sampling plan	Work Plan 206 5th Street South - Great Falls, Montana Grant Number: BF95809510-0
6. Date DEQ approved the sampling plan	2/28/2022 M/D/YY
7. Name of data validator	Corey League
8. Phone	406.760.1321
9. Date validated	4/25/2022 M/D/YY

Field Collection Questions View example (Note: example optimized for viewing in Chrome browser)

10. Sample matrix	☒ Soil ☐ Sediment ☐ Surface water ☐ Groundwater ☐ Tap water ☐ Air (including soil gas) ☐ Other
11. Sample collection start date	3/11/2022 M/D/YY
12. Sample collection end date	3/11/2022 M/D/YY

13. Analytical methods used

Use Add Method button to list multiple methods. Enter any other methods in the field manually.

Add Method	Analytical Method(s)
Delete Method	Petroleum Hydrocarbons-Volatile (VPH): MA-VPH
Delete Method	Extractable Petroleum Hydrocarbons-Screen Analysis: SW8015M
Delete Method	Physical Characteristics: D2974
Delete Method	Volatile Organic Compounds: SW8260B
Delete Method	VOCs by Microextraction-ECD: SW8011

Laboratory-related Questions View example (Note: example optimized for viewing in Chrome browser)

14. Laboratory name and location	Energy Laboratories, Inc., 3161 E. Lyndale Ave., Helena, MT 59604
15. Laboratory project ID	H22030372

16. Were samples received in good condition and at appropriate temperature, chain-of-custody forms complete, and all samples analyzed within holding times?

Yes ◉ No ○ See Below ○ Comments

	Yes	No	See Below	Comments
17. Were all laboratory quality control procedures complied with and is data validated without qualifiers?	○	●	○	Sample BH-4 Surr: p-Bromofluorobenzene spike recovery outside of advisory limits (with acceptable limits in parentheses): 1,2-Dichloroethane - 79.0% (81-144)
17a. Were all calibration verification results within acceptable limits?	●	○		
17b. Were laboratory (method) blank samples free of contamination?	●	○		
17c. Are the percent recoveries and relative percent differences of matrix spike and matrix spike duplicates within quality control limits?	●	○		
17d. Are the laboratory control samples the same matrix as the samples and prepared the same as associated samples?	●	○		
17e. Were laboratory control samples and laboratory control sample duplicate percent recoveries and relative percent differences within laboratory control limits?	●	○		
17f. Were surrogate recoveries within laboratory quality control limits?	●	○		
17g. Were the laboratory duplicate relative percent differences within data validation quality control limits?	●	○		
18. Were the total number of lab method blanks at least 5% of the total number of samples, or as required by the method?	●	○		
19. Were the total number of lab matrix spike samples prepared at least 5% of the total number of samples, or as required by the method?	●	○		

20. Please list any project samples used for matrix spike/matrix spike duplicates.

Add Sample	Lab ID	Field Sample ID	Comments
Delete Sample	H22030296-012AMS		Lab ID does not correspond to a sample gathered by TD&H for this Phase II ESA.
Delete Sample	H22030296-012AMSD		Lab ID does not correspond to a sample gathered by TD&H for this Phase II ESA.
Delete Sample	H22030372-001A	BH-1 [14.0-15.0]	Sample Matrix Spike
Delete Sample	H22030372-001A	BH-1 [14.0-15.0]	Sample Matrix Spike Duplicate
Delete Sample	H22030372-002AMS	BH-2 [14.5-15]	Sample Matrix Spike

Delete Sample	H22030372-002AMSD	BH-2 [14.5-15]	Sample Matrix Spike Duplicate
Delete Sample	H22030396-025AMS		Lab ID does not correspond to a sample gathered by TD&H for this Phase II ESA.
Delete Sample	H22030396-025AMSD		Lab ID does not correspond to a sample gathered by TD&H for this Phase II ESA.

	Yes	No	Comments
21. Is the total number of laboratory control samples at least 5% of the total number of samples?	●	○	

Consultant/Validator Questions View example (Note: example optimized for viewing in Chrome browser)

	Yes	No	Comments
22. Are the detection limits appropriate for the project (i.e. at or below screening levels)?	○	●	1,2-Dibromoethane, MTBE, and two of the benzene samples had detection limits above the RBSL.

If no, explain

	Yes	No	Comments
23. Are the reported units appropriate for the sample matrix (i.e. water results in ug/L, not mg/kg)?	●	○	
24. Do the analytical methods comply with project requirements (e.g. in the SAP, work plan, or QAPP)?	●	○	
25. Do the laboratory reports include all constituents requested to be analyzed on the chain-of-custody or under the sampling plan or other applicable document?	●	○	
26. Is the number of sample blanks (e.g. equipment, trip, or field blanks) equal to at least 10% of the total number of samples, or as otherwise required?	●	○	

	Yes	No	See Below	Comments
27. Are field blanks free from contamination, duplicates collected as required, and field duplicate percent differences within data validation quality control limits?	●	○	○	

28. Please provide an Excel or CSV file to the DEQ project manager (via e-mail or CD) that lists all samples evaluated in this summary and lists any qualified data.
Please use the following format:

Lab ID	Field Sample ID	Qualifiers	Comments (indicate whether the issue biases the results high or low)
Example 48310-2.31E	Example GW-1	R	Sample dropped in lab and unrecoverable
Example 48310-2.32D	Example GW-2		

Please use the following format for qualifiers. See EPA's National Functional Guidelines for more information on qualifiers for unique samples such as dioxins.

Qualifier	Explanation
C	Pesticide and Arochlor results confirmed with GC/MS
J-	Estimated value, may be biased low
J	Analyte identified, but concentration is estimated
J+	Estimated value, may be biased high
NJ	Tentatively identified compound

R	Sample result rejected
U	Analyte analyzed for, but not detected above quantitation limit
UJ	Analyte not detected above CRQL, but CRQL may be inaccurate
X	Pesticide and Arochlor results attempted using GC/MS, but unsuccessful

If you wish to manually enter qualified sample results, please use the table below.

Add Sample	Lab ID	Field Sample ID	Qualifiers	Comments (indicate whether the issue biases the results high or low)
Delete Sample				

29. What is the percent completeness (samples planned versus valid samples collected)? 100 — Comments

30. Was the completeness goal met? Yes (●) No ( ) — Comments

31. Does all data conform to analytical methods and data quality objectives specified for this project? Yes (●) No ( ) — Comments

32. Other general comments or observations?

Split Samples

33. Did DEQ collect split samples? Yes ( ) No (●) — Comments

Print Form | Save As | Open Instructions | Hide Instructions

Montana Department of Environmental Quality
Data Validation Guidelines for Evaluating Analytical Data
(updated January 26, 2018)

This document was assembled by the Montana Department of Environmental Quality Contaminated Site Cleanup Bureau (DEQ) to formalize technical direction for conducting data validation. Data validation is a standardized review process for judging the analytical quality and usefulness of a discrete set of chemical data and is necessary to ensure that data of known and documented quality are used in making environmental decisions.

While these guidelines are generally used by DEQ, there may be circumstances that warrant a higher level of data validation review and DEQ reserves the right to require additional validation. For investigations where x-ray fluorescence (XRF) or other field screening equipment is used, provide an evaluation including the comparison and correlation of field screening data to laboratory confirmation data in the data validation discussion (please see DEQ's frequently asked questions at http://deq.mt.gov/Land/StateSuperfund/FrequentlyAskedQuestions for specifics associated with the use of XRF equipment and data collection/evaluation).

Please complete a separate data validation report for each sample batch as determined by the laboratory (Note: large data collection events may result in multiple batches). A brief summary of this validation report and the acceptability and usability of the data should be included in the text of the project report with the validation report included as an appendix. The data validation should include an assessment of data using the precision, accuracy, representativeness, comparability, and completeness (PARCC) parameters:

Precision: The degree of mutual agreement between individual measurements of the same property under similar conditions.

Combined field and laboratory precision is evaluated by collecting and analyzing field duplicates and then calculating the variance between the samples, typically as a relative percent difference (RPD). Laboratory analytical precision is evaluated

by analyzing matrix spike/matrix spike duplicate (MS/MSD) samples and using the results to calculate an RPD.

Accuracy: The degree of agreement between an analytical measurement and a reference accepted as a true value.

The accuracy of a measurement system can be affected by errors introduced by field contamination, sample preservation, sample handling, sample preparation, and analytical techniques. Analysis of matrix spike/matrix spike duplicate (MS/MSD) samples, laboratory control spikes (LCS) or blank spikes, surrogate standards, and method blanks are typically used to calculate the percent recovery (%R) for evaluating accuracy.

Please note that some methods, such as EPH and VPH, require calibration data. For such methods, please provide and verify the calibration data.

Representativeness: The degree to which sample data accurately and precisely represent the characteristics of a population, variations in a parameter at a sampling point, or an environmental condition that they are intended to represent.

Typically, representative data will be obtained through careful selection of sampling locations and analytical parameters; proper collection and handling of samples; and through use and consistent application of established field and laboratory procedures. Evaluation of field and laboratory blank samples for presence of contaminants can be useful in evaluating representativeness of sample results.

Completeness: A measure of the percentage of project-specific data that is valid.

Valid data are obtained when samples are collected and analyzed in accordance with quality control (QC) procedures outlined in the sampling and analysis plan (SAP), and when none of the QC criteria that affect data usability are exceeded. Once data validation is complete, the number of usable sample results is divided by the total number of sample results planned for the investigation to determine the percent completeness. A completeness goal should be developed for each project (i.e., 100% completeness for residential samples to ensure that all properties requiring sampling are sampled). A discussion of completeness must also examine the number of samples called for in the SAP compared to the number of samples actually collected. Variance between the planned and collected sample numbers should be explained.

Comparability: Expression of the confidence with which one data set can be compared with another.

Comparability of data is achieved by consistently following standard field and laboratory procedures and by using standard measurement units in reporting analytical data.

For complete information regarding data validation, please see the EPA National Functional Guidelines at http://www2.epa.gov/clp/contract-laboratory-program-national-functional-guidelines-data-review

Determination of Data Usability Qualifiers

Step 1: Review QC Parameter and Document Finding	Step 2: Determine Which Samples to Qualify	Step 3: Determine Which Results to Qualify	Step 4: Apply Qualifier and Bias Code
Step 1: Review QC Parameter and Document Finding	Step 2: Determine Which Samples to Qualify	Step 3: Determine Which Results to Qualify	Step 4: Apply Qualifier and Bias Code
Step 1: Review QC Parameter and Document Finding	Step 2: Determine Which Samples to Qualify	Step 3: Determine Which Results to Qualify	Step 4: Apply Qualifier and Bias Code
Step 1: Review QC Parameter and Document Finding	Step 2: Determine Which Samples to Qualify	Step 3: Determine Which Results to Qualify	Step 4: Apply Qualifier and Bias Code

Step 1: Review QC Parameter and Document Finding	Step 2: Determine Which Samples to Qualify	Step 3: Determine Which Results to Qualify	Step 4: Apply Qualifier and Bias Code
Step 1: Review QC Parameter and Document Finding	Step 2: Determine Which Samples to Qualify	Step 3: Determine Which Results to Qualify	Step 4: Apply Qualifier and Bias Code
Step 1: Review QC Parameter and Document Finding	Step 2: Determine Which Samples to Qualify	Step 3: Determine Which Results to Qualify	Step 4: Apply Qualifier and Bias Code
Step 1: Review QC Parameter and Document Finding	Step 2: Determine Which Samples to Qualify	Step 3: Determine Which Results to Qualify	Step 4: Apply Qualifier and Bias Code
Step 1: Review QC Parameter and Document Finding	Step 2: Determine Which Samples to Qualify	Step 3: Determine Which Results to Qualify	Step 4: Apply Qualifier and Bias Code
Step 1: Review QC Parameter and Document Finding	Step 2: Determine Which Samples to Qualify	Step 3: Determine Which Results to Qualify	Step 4: Apply Qualifier and Bias Code
Step 1: Review QC Parameter and Document Finding	Step 2: Determine Which Samples to Qualify	Step 3: Determine Which Results to Qualify	Step 4: Apply Qualifier and Bias Code
Step 1: Review QC Parameter and Document Finding	Step 2: Determine Which Samples to Qualify	Step 3: Determine Which Results to Qualify	Step 4: Apply Qualifier and Bias Code
Step 1: Review QC Parameter and Document Finding	Step 2: Determine Which Samples to Qualify	Step 3: Determine Which Results to Qualify	Step 4: Apply Qualifier and Bias Code
Step 1: Review QC Parameter and Document Finding	Step 2: Determine Which Samples to Qualify	Step 3: Determine Which Results to Qualify	Step 4: Apply Qualifier and Bias Code
Step 1: Review QC Parameter and Document Finding	Step 2: Determine Which Samples to Qualify	Step 3: Determine Which Results to Qualify	Step 4: Apply Qualifier and Bias Code
Step 1: Review QC Parameter and Document Finding	Step 2: Determine Which Samples to Qualify	Step 3: Determine Which Results to Qualify	Step 4: Apply Qualifier and Bias Code
Step 1: Review QC Parameter and Document Finding	Step 2: Determine Which Samples to Qualify	Step 3: Determine Which Results to Qualify	Step 4: Apply Qualifier and Bias Code
Step 1: Review QC Parameter and Document Finding	Step 2: Determine Which Samples to Qualify	Step 3: Determine Which Results to Qualify	Step 4: Apply Qualifier and Bias Code
Step 1: Review QC Parameter and Document Finding	Step 2: Determine Which Samples to Qualify	Step 3: Determine Which Results to Qualify	Step 4: Apply Qualifier and Bias Code
Step 1: Review QC Parameter and Document Finding	Step 2: Determine Which Samples to Qualify	Step 3: Determine Which Results to Qualify	Step 4: Apply Qualifier and Bias Code

Step 1: Review QC Parameter and Document Finding	Step 2: Determine Which Samples to Qualify	Step 3: Determine Which Results to Qualify	Step 4: Apply Qualifier and Bias Code
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Lab Receipt of Samples			
Preservative (including sample temperature) outside of specifications.	Affected samples and professional judgment	Detected Results Non-detected Results	J- UJ or R
Samples not accounted for on Chain-of-Custody	Affected samples	All samples	R
Samples analyzed outside of method specified or technical holding time.	Affected samples	Detected Results Non-detected Results	J- R (UJ for SVOC, pesticides, aroclors)

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Samples analyzed grossly outside of method specified or technical holding time.	Affected samples	Detected Results Non-detected Results	J- R
Lab Quality Control			
Calibration verification results outside of acceptable limits.	Samples associated with initial and/or continuing calibration verification	Detected Results Non-detected Results	J UJ
Analyte detected in Method Blank (MB) at concentration less than Contract Required Quantitation Limit (CRQL)[1] (i.e. , J-flag)	Samples in preparation batch	Detected Results <=CRQL Detected Results >CRQL	U J (use professional judgment)
Analyte detected in Method Blank (MB) at concentration greater than or equal to CRQL	Samples in preparation batch	Detected Results < Blank Concentration Detected Results >= Blank Concentration	U Use professional judgment
Matrix Spike:			
%Recovery above specifications	Sample and professional judgment for samples in preparation batch from same matrix.	Detected Results Non-detected Results	J+ No qualifier
%Recovery below specifications and greater than 20% (30% for inorganics)	Sample and professional judgment for samples in preparation batch from same matrix.	Detected Results Non-detected Results	J- UJ
%Recovery below 20% (30% for inorganics)	Sample and professional judgment for samples in preparation batch from same matrix.	Detected Results Non-detected Results	J- R
Note: If the spiking amount is less than four times the result in the unspiked parent sample, the MS/MSD data may not represent the matrix effect. Professional judgment should be use in evaluating and qualifying the data.			
Laboratory Control Sample:			
%Recovery above specifications	Samples in preparation batch.	Detected Results Non-detected Results	J+ No qualifier
%Recovery below specifications and greater than 20% (40% for inorganics; see NFG for pesticides and Aroclors; 10% for dioxins)	Samples in preparation batch.	Detected Results Non-detected Results	J- UJ
%Recovery below 20% (40% for inorganics; see NFG for pesticides and Aroclors; 10% for dioxins)	Samples in preparation batch.	Detected Results Non-detected Results	J- R
Laboratory Duplicate Samples (including LCSD and MSD):			
Relative Percent Difference outside specifications	Samples in preparation batch.	Detected Results	J
Surrogate Recoveries:			

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Surrogate Recovery greater than Upper Acceptance Limit	Target analytes in sample	Detected Results Non-detected Results	J+ No qualification (UJ for dioxins)
Surrogate Recovery less than Lower Acceptance Limit and greater than 10%	Target analytes in sample	Detected Results Non-detected Results	J- UJ
Surrogate Recovery less than 10%	Target analytes in sample	Detected Results Non-detected Results	J- R (see NFG for dioxins)
Field QC Samples			
Blanks			
Analyte detected in Field Blank, Equipment Blank, and/or Trip Blank at concentration less than Contract Required Quantitation Limit (CRQL)1 (i.e. , J-flag)	Associated samples	Detected Results <CRQL Detected Results >=CRQL	U Use professional judgment
Analyte detected in Field Blank, Equipment Blank, and/or Trip Blank at concentration greater than or equal to CRQL	Associated samples	Detected Results < Blank Concentration Detected Results >= Blank Concentration	U Use professional judgment
Duplicates			
Field Duplicate Relative Percent Difference outside specifications and analyte concentration >=5x CRQL	Associated samples	Detected Results	J
Field Duplicate Relative Percent Difference outside specifications and analyte concentrations <5x CRQL with absolute difference between sample and duplicate > CRQL	Associated samples	Detected Results Non-detected Results	J UJ
Field Duplicate Relative Percent Difference outside specifications and analyte concentrations <5x CRQL with absolute difference between sample and duplicate <= CRQL	Associated samples	Detected Results Non-detected Results	No qualification No qualification
Consultant/Validator Questions			
Reported Units not appropriate for sample matrix	Affected samples	All results	Inquire, document, and use professional judgment
Analytical methods do not comply with project requirements. And/Or Detection Limits not appropriate for the project.	Affected samples	Detected Results Non-detected Results	Use professional judgment Use professional judgment, if Reporting Limits > Screening Levels; results may not be usable
QC Sample Frequency			
Method Blanks analyzed less than 5% of total samples	Use professional judgment	Use professional judgment	Inquire, document, and use professional judgment

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Matrix Spike samples analyzed less than 5% of total samples	Use professional judgment	Use professional judgment	Inquire, document, and use professional judgment
Laboratory Control Samples analyzed less than 5% of total samples	Use professional judgment	Use professional judgment	Inquire, document, and use professional judgment
Field, equipment, or trip blanks analyzed less than required	Use professional judgment	Use professional judgment	Inquire, document, and use professional judgment
Notes:			
1. See the National Functional Guidelines (NFG) for contract required quantitation limit (CRQL) or blank results of common laboratory contaminants, including: methylene chloride, acetone, and 2-butanone.			
2. Screening Levels (SLs) is a generic term which may include Risk Based Screening Levels, Regional Screening Levels, and/or site specific screening levels.			